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The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

A MONTHLY JOURNAL FOR THE INFORMATION OF THOSE INTERESTED
IN THE PURITY OF FOOD AND DRUGS, AND IN GENERAL
ANALYTICAL AND MICROSCOPICAL RESEARCH.

EDITED BY

G. W. WIGNER, F.C.S., LONDON AND AMERICA,

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AND

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THE ANALYST.

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With this number we issue to Subscribers and to Members of the Society of Public Analysts the Index and Title Page to our third volume. Non-Subscribers can obtain them by ordering through their Booksellers at 3d. per copy.

Our readers will please take notice that, to meet the demands of our increased circulation, we have changed our publishing arrangements, and "The Analyst" the fourth volume of which commences with this number, will in future be published by Messrs. Baillière, Tindall & Cox, 20, King William Street, Strand, to whom all business communications are to be addressed. Letters for the Editors are also to be forwarded to that address.

We shall endeavour this year, as we have done previously, to make "The Analyst" more valuable as a purely technical Journal to the numerous and increasing body of practising Analysts in this country, and shall be glad to receive original papers or reports from any chemists who may be willing to become contributors.

THE SOCIETY OF PUBLIC ANALYSTS.

The Annual Meeting of this Society will be held at Burlington House, on Wednesday, the 15th January, when the Officers and Council for 1879 will be elected. The Annual Dinner will afterwards take place, particulars of which will be duly announced by circular to the Members.

ON THE DETECTION AND ESTIMATION OF ALUM IN WHEAT FLOUR.

By A. Dupré, Ph.D., F.R.S.

Read before the Society of Public Analysts on 20th November, 1878.

At our June meeting I stated that I was engaged in the examination of a number of samples of flour, with a view of discovering the relation existing between the amounts of silica and alumina present in pure wheat flour, or, at least, in such flour in which the only extraneous alumina and silica present are derived from the soil adhering to the grain.* It is obvious that if, in unadulterated samples of flour, anything like a regular relation exists between these two constituents, a knowledge of such relation would enable us at once to discover the addition of any appreciable proportion of alum to any given sample of flour. No doubt many analyses will be necessary to fix this relation with a sufficient degree of accuracy, and the analyses given below must only be looked upon as a small contribution towards this end.

Table I. gives the result of the analyses of twelve samples of flour, ranged in order according to the amount of silica they contained. Eleven of these samples were bought at respectable shops in London (partly bakers, partly cornchandlers), and one from a baker at Chelmsford. In none of the samples could any alum be detected. The numbers in the table represent grains in 4-lbs. of flour.

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* *Analyst*, vol. 3, p. 283.

TABLE I.

No. of the Flour.	Silica.	Alumina.	Oxide of Iron.	Alum corresponding to total Alumina.
1	3·08	0·63	0·42	5·58
2	3·42	1·26	0·35	11·16
3	4·93	1·80	0·95	15·94
4	5·54	1·41	0·67	12·49
5	7·28	2·30	1·79	20·37
6	8·17	1·07	0·42	9·48
7	8·85	1·62	0.67	14·35
8	10·36	2·79	1·63	24·72
9	13·80	2·79	0·48	24·72
10	15·57	2·50	1·67	22·15
11	15·79	2·05	1·07	18·16
12	26·91	3·72	1·63	33·06

A glance at this table will show that although there is, in general, an increase in the amount of alumina corresponding roughly with the increasing proportion of silica, yet that such increase is by no means regular; it is therefore obvious that no uniform relation between these two constituents exists, but, nevertheless, a relation sufficiently close for practical purposes may, I believe, be made out. To arrive at this I have divided the flours into three classes. The first class consists of flour containing from 0 to 5 grains of silica in the 4-lbs.; those of the second class contain from 5 to 15; and lastly, those of the third class from 15 to 30 grains silica in the 4-lb. If, in flour of the first class, we multiply the silica by 2·86, we get, approximately, the number of grains of alum corresponding to the amount of alumina naturally present in the flour, or derived from the soil adhering to the grain. In those of the second class this multiplier is 1·90, while in those of the third class it is 1·26.* Table II, gives the amounts of alum thus calculated from the silica as compared with the alum corresponding to the alumina actually found. If the amount of alum thus calculated falls materially short of the amount of alum corresponding to the proportion of alumina found, the presumption would be that alum had been added to the flour.

TABLE II.

No. of Flour.	Alum calculated from the Alumina.	Alum calculated from the Silica.	Difference between columns 3 & 2.
1	5·58	8·81	+ 3·23
2	11·16	9·78	— 1·38
3	15·94	14·10	— 1·84
4	12·42	10·52	— 1·90
5	20·37	13·83	— 6·54
6	9·48	15·52	+ 6·04
7	14·35	16·81	+ 2·46
8	24·72	19·68	— 5·04
9	24·72	26·22	+ 1·50
10	22·15	19·62	— 2·53
11	18·16	19·89	+ 1·73
12	33·06	33·91	+ 0·85

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* In the case of flours with but little silica and alumina, the alumina naturally contained in the flour is probably a considerable proportion of the total quantity found, the rest being derived from the soil. As more and more soil gets mixed with the flour the alumina derived from such soil more and more preponderates. In the first case there is not many times more silica than alumina, in the latter the silica very greatly exceeds the alumina, the relation between these two more and more approaching that found in soils.

The numbers in the table do not by any means agree as closely as might be wished, still, the maximum difference between the number of grains of alum in the 4-lbs. of flour, as calculated from the alumina and silica respectively, amounts to only a little over 6 grains, and this difference is found both positive and negative. It follows that about 12 grains of alum might have been added to 4 lbs. of No. 6 flour, the one extreme, to bring it to the other extreme, No. 5, and this amount of alum, when added to No. 6 flour, could not be detected by the means here proposed. But 12 grains of alum in 4-lbs. of flour correspond to only about 8 grains in the quartern loaf, and this quantity, which is the maximum which could be added under the most favourable conditions without detection, may, I think, be fairly neglected, at least as far as any adulteration injurious to health is concerned. When the amount of silica present is less than 5 grains in 4-lbs. of flour, the proportion of alum which could be added without detection is only about 3 grains to the quartern loaf. I hope some, at least, of our members will take this subject up, and give us their results, taking care always to deal with pure wheat flour only. We should then soon be in a position to correct the numbers given above for multiplying the silica, and thereby most probably increase the accuracy of our results. I have, as will be seen, left the oxide of iron out of consideration for the present, but a more extended experience may enable us to make use of this factor as well. Thus, Nos. 5 and 8, which give the greatest divergence, in one direction, between the two methods of calculation, contain a very high proportion of oxide of iron, relative to the silica, as compared to the other samples. One other point of interest may be mentioned. Nos. 1, 2, 4, 5, 6, 7, and 9, were sold as best flour: Nos. 3, 8, 10, 11, and 12, as seconds; or almost all the best flours are characterised by a low, almost all the seconds by a high proportion of silica. Nos. 9 and 12 were bought at one shop (a corn chandler's), the lower quality having considerably more silica than the higher, and although both these have the highest proportion of silica in their respective classes, still the apparent relation between price and silica holds good.

The method just described, though applicable to flour, will, I believe, be found useful chiefly for the estimation of alum in bread. In the case of bread, it will indeed be, in conjunction with the logwood test, the only tolerably trustworthy process at present available. For the detection and estimation of alum in flour, the following method will, however, be found preferable.

If, as described in my note of June 26th, 100 grams, or less, if much alum be present, of flour are well shaken up with from 300 to 500 cub. cent. of chloroform,* (best in a closed conical separating funnel), and the mixture is then allowed to stand at rest, the flour will rise to the surface, while the mineral impurities will sink to the bottom and can readily be drawn off, together with some chloroform, by means of the lower tap. Most of the alum contained in the flour will be found in this deposit. Small pieces —such, for example, as would just pass through a wire sieve with twenty-four meshes to the linear inch—are deposited in a few minutes, and may readily be extracted, while much smaller pieces could, I have no doubt, be readily seen with the aid of a lens or microscope. In order, however, to test for alum in the deposit, if it cannot be thus mechanically separated, the following plan may be adopted. The deposit is filtered off from the chloroform drawn with it from the funnel, and, when dry, is thoroughly exhausted on the filter with cold water. In this aqueous solution, which will be found distinctly acid even if not more than 10 grains of alum were present in 4-lbs. of flour, sulphuric acid and ammonia (the latter, of course, only if ammonia alum had been used) can be readily detected, but there is generally but little and sometimes no alumina. More or less of the alumina always remains in the residue insoluble in water, probably absorbed by the flour, of which some is always present in the deposit. The alumina is therefore best tested for in a separate portion of deposit, which, for this purpose, is boiled in very dilute hydrochloric acid, which does not act on the soil or clay, and the clear filtrate is tested for the alumina. If the deposit at first obtained is once more shaken up with a little fresh chloroform, a further separation of the alum from the flour, of which a little is always carried down with the mineral matter, may be effected; but this additional trouble is not, I think, necessary.

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* I have used the ordinary methylated chloroform in my experiments, redistilling from a water bath after use, and simply separated it from the water carried over with it by letting it stand for some time.

If the flour is only to be tested qualitatively nothing further is necessary, but if we wish to estimate the amount of alum that may be present somewhat more trouble must be taken. When, after the first thorough and violent shaking up, the lower portion of the chloroform has become clarified, the contents of the funnel are again agitated, but in such a manner as not to disturb the sediment already formed. This shaking up is repeated frequently (a dozen times or so) in the course of a day, and the mixture is then left standing over night. The following morning the deposit formed is drawn off, and the shaking up, &c., &c., repeated during the course of the second day. After a final night's rest, the small amount of deposit which will generally be found is also drawn off and added to the first portion. The deposit, after the chloroform has evaporated, is then extracted, on the filter, and the solution made up to a given bulk, say 50 cub. cent. In from $\frac{1}{20}$ to $\frac{1}{10}$ of this the ammonia may be estimated by Nesslerising, and in the remainder the sulphuric acid is determined as sulphate of barium with the usual precautions, boiling the precipitate first obtained with hydrochloric acid, &c. From the sulphuric acid thus found the alum is calculated either as ammonia or potash alum, as the case may be.[†]

The separation of the alum from the flour by these means is much more complete than one would at first sight imagine. Thus, three mixtures were made, containing respectively 28 grains, 10 grains, and 2 grains of very finely powdered and sifted ammonia alum to 4-lbs. of flour. Portions of 100 grams of each of these flours were treated with chloroform, as above described, for two days, and the sulphuric acid estimated in the cold aqueous extract of the deposits obtained. The results are given in Table III.

TABLE III,

	Amount of Flour taken.	Amount of barium sulphate obtained.	Ammonia alum corresponding to this calculated on 4-lbs.	Ammonia alum actually contained in 4-lbs. Flour.
1st Mixture	100 grams.	0·0997 grams.	27·10 grams.	28 grams.
2nd „	100 „	0·0302 „	8·21 „	10 „
3rd „	100 „	0·0042 „	1·14 „	2 „

[†] If any sulphate of calcium is found in the flour it is necessary to estimate the calcium contained in the aqueous extract of the deposit and to subtract the amount of sulphuric acid with which this is combined from the total amount of sulphuric acid found, and the remainder only is calculated as alum. The presence of any other soluble sulphate must of course also be taken into account.

In the last case the ammonia was also estimated, and amounted to 0·00015 grams in the total aqueous solution, corresponding to 1·004 grains ammonia alum in 4-lbs. of flour.

The pure flour, used in the above experiments, treated in the same way with chloroform, yielded, when 100 grams of flour were taken, a deposit the aqueous extract of which was neutral, yielded no trace of precipitate with barium chloride, and was almost absolutely free from ammonia.

The insoluble residue on the filter may be submitted to the logwood test with great advantage, but only under certain precautions. On applying the test to the insoluble residue of the deposit obtained from pure flour, a strong bluish tint was produced, very much as if alum had been present. Further examination showed that pure moist clay gave a very decided bluish-grey tint with the logwood test, and as the insoluble part of the deposit from flour contains all the soil and clay from such flour, the test as thus used is misleading. The tint produced in clay is, however, darker and less blue than that produced with flour containing alum, and when the mixture is allowed to dry the blue colour disappears almost entirely, being replaced by a pale grey tint with a shade of red in it, whereas the tint produced with flour and alum retains its bluish colour. If, then, we allow the deposit to which we have applied the logwood test to dry up, by exposure to the air over night for example, it will not show any blue colour if the flour from which it was obtained contained no alum, but will be more or less distinctly blue if any alum was present. Even if no more than 2 grains of alum were contained in 4-lbs. of flour, the deposit obtained, as above, from 100 grains of flour will yield a distinctly blue colour, which remains on drying. I have not gone below the proportion of 2 grains of alum per 4-lbs. of flour, but I have no doubt that even smaller quantities might be detected with certainty by the means here described.

Chloroform has, as stated at the end of my former note on this subject, been previously employed for the detection of mineral matters, such as the sulphates of barium or calcium, carbonate of calcium, &c. in flour‡, but only when present in comparatively large quantities, and the amount of flour recommended to be taken would have been insufficient for the detection of alum in the small proportion in which it is usually added. I first employed chloroform with the idea of dissolving out the alum by means of a solvent having little or no action on the flour itself. Various liquids were tried and among them chloroform, as, in consequence of a mistake, I had been led to believe that chloroform dissolved an appreciable proportion of alum. It was only after vainly trying to extract the alum from some flour to which I had added it that I found it to be practically insoluble in chloroform, but that, in consequence of its greater specific gravity, it could readily be detected in the deposit yielded when flour and chloroform are shaken up together and are then allowed to stand at rest.

In conclusion, I may remark that, as far as my present experience goes, no flour need be examined for alum if when examined by the logwood test it yields no indication of its presence. Should, however, alum be indicated by this test the flour must be submitted to other tests, in order not only to confirm the presence of alum but also to estimate its amount.

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‡ C. Himley, Wagner's Jahresbericht, 1876, p. 699.

NOTE ON THE DETECTION OF ALUM IN FLOUR BY THE LOGWOOD TEST.

By W. C. Young, F.C.S.

Read before the Society of Public Analysts, on 26th June, 1878.

It must be admitted that a distinctive test, such as the logwood, would possess great value if the reaction given by it could be strictly assured in all cases where alum is present.

At the present time, however, very few chemists have any faith in it as a test for alum in flour, so often have they failed in obtaining any indication of its presence even when it has been purposely added.

With bread the case is different, as I have never failed to get the desired reaction when trying it upon samples to which alum has been added in the process of manufacture.

At first sight it is difficult to see why the reaction is not obtained with alumnised flour; in the case of bread one would expect some interference by reason of the decomposition of the alum which undoubtedly takes place in the baking, but in flour the alum must remain unaltered.

Various reasons have been given to account for this difficulty, of which I may mention, the use of old logwood chips (or such as had been exposed to the air) for making the tincture; and the use of a wrong proportion of carbonate of ammonium solution to tincture of logwood.

I have had recently several samples of flour, which, upon analysis gave quantities of phosphate of alumina equal to alum, varying from 15 to 25 grains in 4-lbs., and as I could not in any of them obtain an indication by the logwood test, I felt I could not safely, in the face of what has recently occured at Selby, certify that it was present; at the same time I confess that if that case had terminated differently I should have done so. In connection with the examination of these samples I mixed alum with flour in progressive quantities, and, except in a few cases, failed to get the reaction, and in these few the colour was in patches in the under portion of the mass, the surface colour being the dirty brown usually given after standing a time when alum is absent, so that it may well have been passed as pure. I then applied the test to powdered alum and found that the colour came very slowly, and where a considerable amount of carbonate of ammonium had been used, the deep claret colour had changed to brown in the upper part of the liquid, before anything like the blue appeared in the lower.

This result clearly indicated a solution of the difficulty, as it showed that it was necessary to have the alum dissolved in water before applying the test, and upon mixing the flour to a thin paste with boiling water previous to adding the ammoniacal logwood tincture, a blueish grey colour is developed in a few minutes, which is unmistakeable with so small a quantity as 5 grains of alum to 4-lbs. of flour; the colour stands well for seven days, whereas the ordinary colour obtained without alum will not last as many hours.

Treated in this way the test answers well, no matter what age the logwood tincture may be, or what the character of the chips from which it is made, always provided that the deep claret colour is produced in it on the addition of solution of carbonate of ammonium.

It appears to me very probable that the varying results I have hitherto obtained may be due to the circumstance of my having added more at one time than another of carbonate of ammonia, thus rendering the solution of the alum in some cases more easy than in others.

How far these few facts affect the value of the decision of the Inland Revenue chemists in the "Selby" flour case, of course I am unable to say, but should it appear that they applied the test before having made sure that the alum was dissolved, I make bold to assert that they would have obtained no indication even had there been twice as much alum present as was certified by Mr. Allen.

ON THE LOGWOOD TEST FOR ALUM.

By W. W. Stoddart, F.I.C., &c.

In the year 1858 Mr. Hadow, when demonstrator of chemistry in King's College proposed as a test for the presence of alum in bread the decoction of logwood, with the mode of preparation and method of applying it, as an easy and effectual test. He affirmed that he could, without difficulty, detect 5·7 grains of alum in each pound of bread. About three or four years afterwards Mr. Horsley, of Cheltenham, published a peculiar method of application, so that a much smaller quantity of alum may be made evident. With or without alum the bread is coloured a strong and distinct purple colour, but when the bread is afterwards exposed on a porcelain capsule to the atmosphere for a few hours, if alum is absent the beautiful colour disappears, and a dull *brown* takes its place, but if alum has been mixed with the bread a conspicuous and beautiful blue is the permanent result. I have, for some years, been in the habit of employing the logwood test, in the manner recommended by Mr. Horsley, invariably with a successful and reliable result, so much so that I was astonished at hearing and reading that several analysts had found the test useless. Dr. Hassall, in the last edition of "Food and its Adulterations," says, "The logwood test is fallacious. We have frequently employed this test in cases in which alum has been present without obtaining the slightest violet coloration."

So invariably have I found the reverse happen that I have often wondered why so many good chemists have failed.

I think the cause of disappointment is in the logwood itself. The wood must be freshly cut and kept in a stoppered bottle, secure from the atmosphere. The decoction or alcoholic tincture also must be recently prepared. If this precaution be not strictly observed, the logwood test is quite useless. I have frequently found that, where the tincture has been made for some months, that even strong ammonia or solution of potass has not had any effect in altering the colour of the logwood solution. The fact is that the usefulness of this test is altogether dependent on the presence of hœmateate of ammonia, which is instantly formed when ammonia is added to hœmatoxylin.

If a few crystals of fresh hœmatoxylin be used instead of the wood itself, the same reaction is produced. The solution on exposure to air changes to a *brown*, but if a trace of alum be present, a beautiful and striking *blue* is left instead.

My experience has been so invariable and distinctive, that if this singular reaction is wanting I do not proceed further in the analysis.

Of course I need not say, I always perform the chemical separation of alumina and sulphuric acid before evidence of adulteration is shewn in a court of justice, although I really think the logwood test, if properly made, is quite decisive.

ON THE NITROGENOUS CONSTITUENTS OF COCOA.

By G. W. Wigner, F.C.S.,

Read before the Society of Public Analysts, on 20th November, 1878.

Cocoa has been constantly referred to as one of the most nutritious foods, because of the high proportion of nitrogenous matter contained in it. Payen in the analysis of nibs, free from husk, found 21·2 per cent. of albuminous matters, and Church in the recent guide to the Bethnal Green Food Collection, gives 17 per cent. of albuminous matters, as the average of pure roasted cocoa nibs. Heisch examined a number of samples of roasted cocoa beans obtained from different localities, the results of which were published in *The Analyst*;* but in most cases, he found figures considerably lower than these; the highest amount yielded by his samples was 2·06 of nitrogen, corresponding to 13·03 per cent. of albuminous matters, and the lowest was 1·17 per cent. of nitrogen, corresponding to 7·40 per cent. of albuminous matters. All these determinations appear to have been made by the estimation of nitrogen by the soda lime process, and the calculation of the albuminoids from the total nitrogen found.

The recent investigations of Church and others on the form in which the nitrogenous matters exist in roots and cereals, and my own recently published investigations on the nitrogen compounds present in the cereals, led me to think, that the nutritive quality of cocoa might possibly have been somewhat over estimated, owing to the non-separation of the coagulable from the non-coagulable albuminoids. This process gives us two determinations, one of the total nitrogen, and one of the coagulable nitrogen, both subject, of course, to the errors due to the soda lime process. The latter determination, viz., coagulable nitrogen, is the only one, which in the present state of our knowledge, we are justified in assuming as really flesh forming matter, since it is this only which can be classed as true albuminoid matter. The non-coagulable nitrogen may, and part of it unquestionably does exist in the forms of nitrates and nitrites, and another part exists in the form of alkaloids, and at present, we have nothing to prove that either of these are properly classed as flesh formers.

If therefore, this proportion of non-coagulable nitrogen is found to be high in any food, it follows, that we must consider its nutritive value as being so much lower than had been hitherto supposed when the calculation was made from the total nitrogen.

Now in the cases of wheat, barley and oats, I find that various proportions, sometimes as much as 35 per cent. of the total nitrogen, are in non-coagulable forms, and on extending this enquiry to cocoa, I find that the percentage of the total nitrogen so present is in many cases higher than even these figures.

I have, of course, been able to examine only a limited number of samples, and therefore, I have selected six ordinary commercial samples, and four samples of entire cocoa beans. The commercial samples are practically certain to be admixtures of different varieties of cocoa, and therefore, in a case like this they will give a more correct general impression than selected samples of special varieties. It is true that most of the commercial samples contain an admixture of either starch or flour, but by bearing in mind that average flour contains about 90 per cent. of its nitrogen in a coagulable form, it is easy to make the allowance for this admixture.

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* Vol. 1., p. 142.

I am indebted to Mr. Heisch for the four samples of roasted beans. The determinations in these cases have been made on the entire bean, the husk not being removed.

The following are the results obtained :—

NITROGENOUS MATTERS IN ORIGINAL SAMPLES.

Mark.	Total N.	Coagulable N.	Total albuminoids = N × 6·33	Coagulable albuminoids = N × 6·33	Difference = Non-coagulable nitrogenous matter.	per cent. Total N. coagulable.
A	1.095	·600	6·92	3·80	3·12	54·9
B	1·162	·760	7·35	4·81	2·54	65·5
C	2·978	2·335	18·84	14·79	4·05	78·5
D	·965	·375	6·11	2·37	3·74	38·8
E	·699	·330	4·42	2·09	2·33	47·3
F	1·201	·770	7·61	4·88	2·73	64·1
Socunza	2·040	1·175	12·92	7·44	4·48	57·6
Para	2·000	1·045	12·67	6·62	6·05	52·2
Trinidad	1·490	1·050	9·46	6·65	2·81	70·3
Grenada	2·370	1·335	14·99	7·56	7·43	50·4

It thus appears, that even in the very best of the samples, 21·5 per cent. of the nitrogenous matter present is in a non-coagulable form, and cannnot, therefore, in the present state of our knowledge be recognized as of value as a flesh former. While in the case of the prepared cocoas, the proportion present as true gluten falls in one case to 39 per cent. of the total quantity, and in the case of one of the entire cocoa beans to about half of the total found by the ordinary combustion. The average of the entire beans being 57·6 per cent. of the nitrogen in the coagulable form.

Until the nutritive value of non-coagulable albuminoids is proved, cocoa must therefore rank far lower in the scale of foods than it has done hitherto.

ON A FERMENT PRODUCED BY THE MORBID GROWTH OF THE BIOPLASM OF THE YOLK OF EGG.

By William Thomson, F.R.S.E.

I have read with interest the two cases of mysterious poisoning—the one described by Mr. A. H. Allen, the other by Dr. Muter—in the November issue of your valuable journal, and each recalls to my mind a peculiar ferment studied by the late Dr. F. Grace-Calvert and myself some years ago. It was a cell which propagated itself in the same manner as yeast, and when it developed in large quantity in any fluid it emitted such a fulsome, putrid odour, that we termed it the "putrid cell." We traced the origin of this cell in egg albumen solutions to the yolk of the egg, and it appeared to us that it was a morbid growth of the bioplasts of the yolk, which, had they followed their normal course of development, would have gone to form the bone, flesh, tissues, etc., of the chicken.

Our attentions was first drawn to this ferment by observing that when eggs were left under certain conditions, some putrified, and when the contents of the rotten eggs were microscopically examined, none of the generally recognised putrifactive ferments, such as bacteria, nor any fungoid growths, could be observed, but the contents were full of cells of very different sizes, but of the same conformation. When this decomposition had gone far we found the yolk entirely disintegrated and mixed up completely with the white; but when the growth had not gone so far we found that the yolk had swelled out more or less and the white had become milky from the presence of "putrid cells" in it. The yolk generally swelled to about twice its original size before bursting. On microscopical examination of one of these swelled yolks, in comparison with a healthy one, we saw that the minute granules, which resembled minute dots, and which constituted the healthy yolk, had each swelled out in the abnormal yolk and appeared there as distinct cells of different sizes.

As an example of the conditions under which this growth will take place I may mention a series of experiments in which a number of eggs were well coated with shellac and left for about eighteen months. After that time the coating was still perfect, and some, on being broken, were found to be perfectly fresh and good, but on striking the shell of one with the point of my knife it burst from the pressure of gas inside, scattering the contents in all directions. The contents had evidently lost no moisture by evaporation, and the yolk was entirely disintegrated and thoroughly mixed up with the white, and the whole emitted a disgusting putrid smell. The microscope revealed the presence of our old friend the "putrid cell" as being the sole cause of this decomposition. These cells are, we believe, not entirely confined to the yolk of egg and egg albumen, because we have observed cells of precisely the same appearance in other fluids, such, for instance, as in water in which putrid meat had been washed. I now come to the question of the physiological effects of these cells, or of the products produced by their growth; only one experiment was made on this point, and I therefore do not give the result as by any means conclusive. A healthy dog was put under chloroform, a small triangular flap of skin dissected away, a blood vessel exposed, and about 20 grains measure of an albumen solution swarming with bacteria, injected into its blood by means of a morphia syringe, and the small wound dressed. The dog was all right about half-an-hour afterwards and remained in excellent spirit and health during about the next two months: at the end of that time we desired to observe the physiological effects of an animalcule, which we obtained by washing the outside of the shell of an egg with a solution of albumen. It resembled a corkscrew, its body remaining almost perfectly rigid, and its length was from 1½ to 2 turns of the screw, and it propelled itself by turning rapidly round, and thus went through the fluid on the same principle as a corkscrew goes through a cork. About 20 grains of a fluid swarming with this kind of animalcule was injected into the blood of the dog by the same process as above described, this had no injurious effect upon it and it continued to live a long time afterwards in as good health as before. We then decided to try a third experiment on the physiological action of the "putrid cell." Part of the contents of an egg which had been thoroughly disintegrated by this morbid growth was diffused through a little albumen solution and 20 grains of it injected as before into the blood of the dog, but almost immediately afterwards the dog had a slight convulsion and died. It is possible that this was due to the poisonous action of the "putrid cell" or products produced by it, but as the experiment was not again repeated I am not prepared to say that the chloroform had nothing to do with its death, and unfortunately it will now be illegal for me to repeat the experiment. The experiment is, however, given for what it is worth.

In conclusion, I would simply ask, first, whether this ferment has not been the cause of the foul odour and poisonous effects of the sample of milk, described by Dr. Muter, and produced under special conditions either directly from the milk itself or from some foreign organized granules or cells in it?—and, secondly, whether the eggs in the bread pudding might not have been the direct cause of this ferment, and the ferment the cause of the poisonous effects which the bread pudding produced, and which were so well described by Mr. A. H. Allen.

AMOUNT OF SOLIDS IN MILK.

By Charles A. Cameron, M.D.

As a contribution towards a solution of the question as to the minimum amount of solids in milk, the following may be of some assistance :—

About two years ago a somewhat large number of specimens of milk were sent to me for analysis by the Corporation of Drogheda. Very few of them were of fair quality, some were of very doubtful composition, others were partly skimmed or were watered. Several of the vendors of the skimmed and watered milks were prosecuted and fined. A second batch of samples of milk was subsequently sent up, and exhibited a marked improvement—only one specimen was largely adulterated, and its vendor was prosecuted and fined. The result is that the milk sold in Drogheda during the present year appears to be perfectly free from adulteration. I shall not give full details of analyses but merely the total solids in each of the specimens sent from time to time in 1878. Percentage of solids:—13·49, 13·60, 13·90, 12·55, 13·70, 12·75, 13·52, 13·10, 13·00. 13·15, 12·30, 12·98, 12·19, 12·75, 12·36, 12·89, 12·25, 14·79, 13·34, 14·55, 14·48, 13·89, 12·80, 12·82, 12·80, 13·00. Average of the 26 specimens, 13·31. These 26 samples of milk were taken partly from the supplies brought into town by the country people and disposed of to the local dealers, partly from the milk of the local cowkeepers. The samples were taken without any previous warning, the inspector of food being put into motion by the borough surveyor. We may take it for certain then that the milk of the dairy cows in the neighbourhood of Drogheda contains on the average more than 13 per cent. of solids. The minimum amount in the 26 samples was 12·19, the maximum 14·79. More than one half contained over 13 per cent. of solids. Ten grammes of each sample were evaporated to dryness in a shallow capsule, and care taken to ensure thorough dessication.

REVIEWS.

BAYLEY'S CHEMIST'S POCKET BOOK.*

We have rarely seen a more useful book than this. It contains a large amount of information useful not only to chemists but to chemical manufacturers of all kinds, and it is a handy book for students. It contains very complete tables on the various matters, including a valuable abstract of the co-efficient tables from Fresenius, for the calculation of the weights of substances sought from those found, comprehensive tables for the conversion of weights, tables as full as any we have recently seen, of the boiling points, specific gravity, vapour densities and solubilities of a large number of compounds, a useful abstract of the dictionary of solubilities—more valuable perhaps than it would otherwise have been, because of the difficulty of procuring copies of Storer's work on the subject, and a fairly comprehensive scheme of qualitative analysis comprised in a really small space, and yet intelligible. We cannot do better than recommend our readers to procure the book for themselves, feeling sure they will not regret their purchase. It might have been better had the book been in the form of an ordinary volume, instead of in its present form, as it would have been more handy, but that does not affect the value of the contents, of which we think highly.

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* E. & F. Spon.

THE HOUSE SURGEON OR THE DOCTOR AT HOME.

This is a little work written by the late Alfred Smee, and issued by the Accident Insurance Company. It makes no pretensions to give full details of treatment, but only just sufficient information to enable any person, with ordinary sense and a few simple appliances at hand, to treat most of the common and some of the uncommon accidents in a sensible and efficient way until medical help can be procured. To say the least it is a useful book, the study of which may often save a great deal of after suffering from accident.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—I enclose a newspaper account of an interesting milk case which has just been dismissed on the "non-prejudice of purchaser" ground.

You will note the ingenious character of the adulteration. The milk was simply diluted by an addition of 20 per cent. of a solution of cane sugar in water, having the same specific gravity as ordinary milk, or nearly so; the consequence was that the total solids were 12·37 per cent., while the ash was only ·67. The fat amounted to 3 per cent.; the solids not fat therefore 9·37. This made up—

Caseine, &c.	2·9
Milk Sugar	2·8
Cane Sugar	3·1
Ash	·67
	9·37

The whey of a milk sophisticated in this way may, of course, be very easily tested for cane sugar by dividing a measured quantity into two parts, inverting the sugar in one half by $H^2 SO^4$, and titrating both with Fehling.

Yours truly,

J. H. COLLINS,

Public Analyst for the County of Cornwall, the City of Truro, and the Boroughs of Penzance and Launceston.

December, 1878.

Truro.

LAW REPORTS.

Bath Police Court.—Before the Mayor (in the chair), Dr. Cardew, Messrs. Hammond Savage, and Hancock.—George Gwillim, dairyman, of 1, Margaret's Hill, was summoned, by adjournment, for selling to Inspector Montagu a half pound of fresh butter to which water had been added. The certificate from the laboratory of Somerset House, to obtain which the case had been adjourned, was as follows:—"We hereby certify that we have analysed the butter and declare the results of our analysis to be as follows: Water, 23·27 per cent.; salt, ·78 per cent.; curd, 1·26 per cent.; butter fat, 74·69. The proportion of water in the sample, without allowing for loss by evaporation, is in excess of that found in recognised commercial samples of butter. The results of our analyses of numerous samples of ordinary commercial butters obtained from different parts of the country, including the South of England, show that the proportion of water present is very variable, and that it occasionally amounts to as much as 19 per cent. (Signed), J. Bell, H. J. Helm, G. Lewin."—The Bench, after a slight consultation, said they considered the case proved, and fined the defendant £10 and costs, or a month's imprisonment.

Alleged Adulteration of Milk.—At the St. Columb Petty Sessions, lately, before Messrs. Bennett and Trevan, Samuel Tummon, dairyman, of Newquay, was summoned "for that he on the 17th day of September last, did sell at his house in Newquay, a certain article called milk, which was found on examination by the County Analyst, to be adulterated." Mr. Whitefield appeared for the defendant, Superintendent Marshall, the prosecutor, stated that on the 17th September last he visited defendant's house, and there saw a bucket partly filled with milk, which defendant admitted was similar to what he had been selling, and told witness the milk was for sale. Witness thereupon purchased three half pints, and informed defendant it was for the purpose of being analysed, as complaints had been made as to the quality of the milk sold in Newquay. Witness divided the milk into three parts and filled two bottles, which he sealed in the manner provided by the Act, and took away the same with him, and left the remainder with the defendant. He subsequently delivered one of the bottles to the public analyst at Truro (Mr. J. H. Collins), and retained the one produced. On the 1st of October he received from the analyst his certificate produced. The certificate was read, which stated that the milk submitted was mixed with at least 20 per cent. of water and contained 3 per cent. of sugar. The analyst expressed his belief that a portion of cream had been removed, and that an ingenious adulteration had been committed. In cross-examination, Superintendent Marshall admitted that he bought the milk for analysis and not for consumption. Mr. Whitefield, in defence, contended that the summons failed to disclose any offence within the meaning of the "Food and Drugs' Act, 1875," and therefore the summons ought to be dismissed. The Bench, after consultation, over-ruled the objection. Mr. Whitefield then argued that, inasmuch as the milk had been purchased for the purpose of analysis, and not for consumption, it was not sold "to the prejudice of the purchaser," within the meaning of the 6th section of the Act. The Bench thought this was a fatal objection, and dismissed the case.—*Western Daily Mercury, Nov. 27th*, 1878.

CLERKENWELL.—Frederick Wilson, provision dealer, of 4, Eagle Street, Holborn, was summoned by the St. Giles's District Board of Health for selling adulterated butter. The clerk of the Board appeared for the prosecution, and the evidence of an inspector of the parish showed that on the 17th of November he asked at the defendant's shop for a pound of butter. He paid 1s. 4d. for what he received in answer to his request, and then told the defendant that the stuff would be analysed. The certificate of Dr. Edmund, analyst of the parish, showed that there was no "butter" in the article. It was "animal fat other than butter fat, and not injurious to health." The defendant said he sold it as he received it. He was ordered to pay a fine of 40s., the decision not to take effect until after the decision by the High Court in the special case granted by Sir James Ingham. The Vestry Clerk said that would be heard about February 11th next. The decision was formally suspended until that date. Catherine M'Dermott, milk seller, of 56, the Colonnade, St. Giles's, was also summoned for selling milk adulterated with water to the extent of 18 per cent. The defendant was fined 40s., the decision, as in the previous case, not to take effect until after February 11th.—*Times.*

BOW STREET.—ADULTERATION OF BEER.—Joseph Howett, of the "Swan and Sugarloaf" public-house, Fetter Lane, was summoned by the Excise for having adulterated his beer by mixing it with "put sugar." Mr. Highmore, from the Inland Revenue, explained that "put" was a term used to define a course brown sugar, the refuse of scraping of barrels, which was sold at a cheap rate, and had the virtue of obsorbing more water, and imparting a "crispiness" to beer which a finer sugar, sometimes used by brewers, failed to accomplish. He called Mr. James Davis, an Excise-officer, and Mr. G. N. Stoker. analytical chemist of Somerset House, who proved that a sample of beer handed to him by Fredrick Partiger, Excise-officer, contained some of the sugar, which he said was used by retail dealers, and sometimes by brewers, as a substitute for malt, to give a "fictitious strength" to their beer. Partiger deposed to having found three bags of the sugar, weighing 5lb, behind a beer-barrel in the cellar, besides forty-three empty paper bags in which sugar had been evidently placed. He tasted the beer "on tap," and also beer which had been just received from the brewers, and he found the former sweeter than the latter. He brought samples of both away, and also a portion of the sugar. In cross-examination by Mr. Montagu Williams, who appeared for the defendant, witness stated that he had not brought any of the samples to the court, and he admitted that, after the summons was served, he called on the defendant and told him it was "not a very serious matter," and advised him to petition the board. Mr. Williams contended that there had been no infringement of the Act, and that no proof of the quality of the sugar was before the Court. Sir James Ingham was of opinion that sugar had been used by the defendant for the illegal purpose of fortifying his beer and giving it attractive qualities which were illegitimate. The fine for this offence was £200, but he would mitigate the penalty to £50.

LAMBETH.—ADULTERATION OF MILK.—Thomas Bowhill, of Tindall Street, Lothian Road, Camberwell, appeared to a summons taken out by Inspector Sedgley, on behalf of the Vestry, for selling adulterated milk. The milk was purchased of defendant's lad in the street, and the analysis showed it was adulterated with water to the extent of 8 per cent.—Defendant said he had sold the milk as he bought it from the wholesale dealer.—Mr. Chance advised him, as, he observed, he did all others who made the same defence, to obtain a warranty with the milk they purchased. He fined defendant 10s., and 12s. 6d. costs. Thomas Harding, of Sussex Dairy, Bishop's Road, Vassall Road, was fined 40s., and 12s. 6d. costs, for selling milk adulterated with water to the extent of 11 per cent. Samuel Wright, milkseller, keeping a shop in Peckham, was also summoned by Inspector Stevens for a like offence. The milk was adulterated with 19 per cent. of added water. Fined £5, and 12s. 6d. costs. David Lloyd, of Sultan Street, Camberwell, was also summoned by Inspector Sedgley for selling milk found upon analysis to be adulterated with 21 per cent. of added water. Inspector Sedgley, in answer to Mr. Chance, said defendant supplied the outdoor paupers on orders from the medical officer. Mr. Chance observed that it was bad enough to sell adulterated milk to the ordinary public, but when it was supplied to the very poor, and often sick poor, it was a great deal worse. He ordered the defendant to pay a fine of £10, and 12s. 6d. costs.

Violet Powder.—Mr. Lund, chemist, of Rosemary Road, Peckham, appeared to an adjourned summons for having sold violet powder in an adulterated condition. Mr. Marsden prosecuted on behalf of the Vestry. Upon the first hearing, the analysis of Dr. Bernays showed that the powder purchased by Inspector Sedgley consisted almost entirely of sulphate of lime or plaster of Paris, and was not fitted for the purpose to which it is usually put. Mr. Chance said he was hardly satisfied as to what violet powder really should be, and the matter was adjourned. On the adjourned hearing, Dr. Bernays, pointed out that it had been deemed necessary that such an article should be considered a drug. It was being constantly used as an outward application for children. What the best chemists in the kingdome sold as violet powder was made of pure starch scented by orris root. The object of violet powder being used was to prevent irritation and absorb moisture. The article in question would not answer that purpose, but might possibly be used hundreds of times without injurious effects. The defendant said it was not the powder he sold generally. It was some sent in packets from a firm, and, having a showy sort of cover, he had put it in the shop window. The powder he sold, as a rule, was pure. Dr. Bernays examined some of the latter, and said that was so. The defendant stated that he first gave the inspector some of this powder; but, as he said it was not enough, he gave him the packet from the window. Inspector Sedgley said the defendant remarked, when he knew the powder was to be examined, that he would sooner sell some of his own make, as he knew nothing of the nature of the other. Mr. Chance remarked that the inference would be drawn that if the packet was in the window, it was for sale. He only however, called upon defendant to pay 12s. 6d. costs, and advised him not to sell such packets again.

Remarkable Case of Milk Adulteration.—A curious case of milk adulteration has occurred at Castlerea, County of Roscommon. A sample of milk supplied by Bedilia Leech to the Castlerea Workhouse was sent to Dr. Cameron, County Analyst, for analysis, who reported that it was adulterated with 16 per cent. of water. A sample similar to that sent to Dr. Cameron had been delivered to the contractor in the usual way (sealed with the Union seal), and a third sample was preserved, also sealed up. When the case came for hearing before the Castlerea Magistrates, the defendant's solicitor produced certificate from Dr. Tichborne, to whom defendant had sent as alleged the sample of milk given to her. The certificate not being legal evidence the case was adjourned for the production of the analysts, but Dr. Cameron only appeared. Dr. Tichborne's certificate was handed him, and upon reading it, he exclaimed that no milk ever had such a composition as that described in the analysis, which stated that it contained 19·1 per cent. of solids, including 12 per cent. of fats. He said that assuming the analysis to be correct, of which he had no doubt, it was cream, and not the sealed sample of milk which defendant had sent to Dr. Tichborne. Finally it was decided that the third sample of the milk produced in Court should be sent to Somerset House for analysis. On Saturday, the 21st instant, the Court sat and announced that the Somerset House Chemists had confirmed Dr. Cameron's analysis. The defendant was fined the highest penalty, £20 and costs. This case shews that it is in the power of vendors to tamper with the duplicate samples left with them. If ordinary milk had been sent to Dr. Tichborne for analysis instead of cream, it must have appeared as if either of the analysts had made a mistake.

Analyst for Dorset.—The question as to the appointment of an analyst for the county of Dorset has been discussed in two of the boroughs during the past few days. Mr. J. Comyns Leach, of Sturminster Newton, has been suggested by the city magistrates as a likely person for the office, and they hint that the boroughs would do well to co-operate in the appointment. In some quarters, however, there is a little demur to this, and it is thought the office should be open—the place being advertised in the usual manner. At the meeting of the Dorchester Town Council recently it transpired that a medical gentleman of the locality, Dr. George, had offered to act as analyst for the borough at a salary of £20 per annum, and 10s. 6d. fee, or a grant of £40 for chemical apparatus, reagents, &c., the apparatus to be the property of the Council. Mr. Emson moved, and Mr. Barnett seconded, the acceptance of the offer. Alderman Galpin proposed as an amendment that before the appointment the terms on which Mr. Comyns Leach would accept the office be ascertained. The Mayor (Mr. A. Pope) expressed himself in favour of a salary of £20 to include the public analysis, and for the private analysis the 10s. 6d. fee as provided by the Act of Parliament. Further conversation ensued, and eventually it was agreed, on the motion of Alderman Lock, seconded by Alderman Galpin, to postpone the appointment. At a meeting of the Poole Town Council it has been agreed unanimously to co-operate with the county in the appointment of Mr. Leach, subject to approval as to terms.

At the last meeting of the Middlesex magistrates the "prejudice to purchaser" question was referred to by Sir J. H. Maxwell who said that he thought it was not probable with the strongly declared views, that the Lord Chief Justice of England would be likely to alter his opinion. He had spoken to two or three members of the House of Commons upon the subject, and when the words were proposed "without prejudice to the purchaser," they opposed their insertion in the Act as they foresaw the result that would occur. An analyst was appointed every year at a high salary for the purpose of carrying out the Act, but at present his hands were tied altogether. After the passing of the Act a number of articles were sold pure in consequence of the prosecutions, but if that Act was to be abrogated the same system of adulteration would soon be revived, and he thought the Court should take action in the matter for the purpose of obtaining an amendment of the Act. He therefore moved, "That in the opinion of this Court the Sale of Food and Drugs' Act, 1875, requires amendment in order to render proceedings for selling adulterated articles more simple and effectual; and a copy of this be sent to the Secretary of State for the Home Department."

Mr. Forsyth, M.P., seconded the motion, and remarked that, however adulterated an article, on analysis, might be found to be, with the present ruling a conviction could not be obtained, as it could not be shown that it had been purchased to the prejudice of the purchaser, and he saw no remedy but fresh legislation, as he had no doubt that the opinion of the Lord Chief Justice would be followed all over the country.

After some discussion the motion was then put, and negatived by 14 to 6.

NOTES OF THE MONTH.

The great violet powder question is still as far off settlement as ever, for on the one hand, we have the Salford magistrates in quarter sessions assembled, solemnly declaring on the evidence of Dr. Redwood, that violet powder is anything which persons may choose to sell, while on the other, we have a London stipendiary magistrate holding on the statement of Dr. Bernays, that violet powder is and should be only starch scented with orris root. It appears to us, as independent spectators, that this is just one of these cases, where, by a little judicious manipulation, the supreme Court may be induced to decide either way, and any number of scientific witnesses may be called on each side. To make our proposition clear, let us for a moment try to trace the real position of violet powder, at the date of the passing of the sale of Food and Drugs' Act. The best evidence which can be had as to what this article should really be, is that of a respectable and qualified class of men like the pharmacists. Now it so happens that we have special opportunities of gathering the opinions of such men, and with the view of obtaining reliable data as to the recognised composition of this and other similarly mis-named articles, we have for some years been making the enquiry, "How do you make violet powder?" and registering the result. This question has been put to nearly one thousand practical pharmacists, and the answers may be summarised as follows:—

Starch and orris root	70 per cent.
Starch, orris root and various perfumes	5 "
Starch, orris root and magnesia	20 "
Starch, orris root, and French chalk, or magnesia and French chalk	5 "
	100 per cent.

It is thus perfectly clear, that, as really made by chemists themselves, the base of true violet powder is starch. But of late years, since the advantage of advertising apparently cheap articles in packets has become evident, a class of houses have sprung up who make such packets and supply them extensively to oilmen, perfumers and others, not licensed chemists. This seriously interferes with the legitimate business of the pharmacist, and he is, in certain districts, compelled in self-defence to vend such packets, as he cannot sell his own articles at the price for which these may be obtained from the oilmen. It is in the packet powder that the happy idea of vending purely mineral ingredients, such as sulphate of lime, selenite &c. has been developed, and the present fight is not between the true pharmacists and the authorities, but, between the producers of each articles and those who desire to see the legitimate preparation of the chemists maintained. It is therefore evident, that when requiring scientific evidence for the defence, such as that offered by Professor Redwood, it is simply necessary to collect and send to your witness packet powders only, and then he cannot help stating the fact, that sulphate of lime is the chief ingredient. On the other hand, let one hundred samples of violet powder be bought from chemists only, (not in packets, but of their own manufacture,) and submitted to the same analyst, and he would be obliged to tell a perfectly different tale in the witness box. The whole thing turns on the question, ought scented mineral powders in packets, sold by anyone, to be allowed to take the place in the public mind, of the article usually prepared by the chemists themselves, without compelling the adoption of some distinguishing title, such as "mineral violet powder," or, selenite dusting powder?" We make these remarks, in order to show how difficult it is to have the honest facts of any case brought clearly before a Court of Law. Meantime we think it is a question, looking to the state of the present case, whether it is wise for analysts to give certificates without clearly stating that violet powder is at the moment an article entirely destitute of a true standard of purity. For their own sakes, some respectable pharmacists should combine and have a test case thoroughly argued and carried to the Supreme Court, by which means they might get rid of the packet incubus, so far as having a definite line of demarcation laid down between genuine violet powder prepared with starch, and mineral dusting powders, and then the rest must remain with the public themselves to choose between quality and price.

We print a report of a case dismissed under the prejudice to purchaser quibble, which is interesting, as showing that our unsophisticated country dealers are quite as wide awake as the London purveyors of milk. Mr. Samuel Tummon must be looked upon with the greatest respect, as a man who has deeply studied his subject, and calls chemistry to his aid, by adding to his milk a solution of sugar, having exactly the specific gravity of the genuine article. Henceforth, the sign of the scientific milkman should contain the notice, "Dairy Laboratory entrance next door!"

The butter case at Bath (reported in our legal columns) must be looked upon as an immense step in the right direction, for we have here a definite standard of 19 per cent. as the amount of water in butter laid down by the Inland Revenue Chemists, and henceforth, analysts and the appeal chemists will be in accord on this point. It is a strong argument in favour of the idea, that one of the most beneficial amendments which could be made in the Act, would be an instruction to the Central Authorities to issue from time to time a set of standards to all. They have at Somerset House the necessary staff and time to verify the standards already fixed by our Society, and we are sure that all analysts would be only to glad to accept them, when so verified, and so avoid differences of opinion, which are always to be deplored.

To show how close the analysis of a public analyst and that of the Somerset House Chemists can run, even when one sample has been kept some time before analysis, we give side by side the figures of both analysts in this case.

	Mr. Gatehouse.	Messrs. Bell, Helm, and Lewin.
Water	25·00	23· 7
Salt	·88	·78
Curd	1·16	1·26
Butter Fat	72·96	74·69
	100·00	100·00

It is thus obvious that given a publication of standards such as that already invited by the Society of Public Analysts, the disagreements between them and Somerset House, which still occasionally occur, would be at an end for ever.

The *Brewers' Guardian* reminds us of Bret Harte's heathen Chinee. We can picture the smile of innocence, "child-like and bland," which adorned the countenance of the respected Editor of that excellent publication, when he wrote the following:—

> "The Adulteration Act having become a dead letter in consequence of the decision of the Court of Queen's Bench upon the "prejudice" question, we may naturally expect some alteration in the law next session. Three hundred years ago the authorities in various towns took steps to ensure a supply of pure ale and beer to the public; in those days there were no public analysts, but the officials were called 'ale-tasters.' In 1529 the Mayor of Guildford ordered that 'the brewers make a good useful ale, that they sell none until it be tasted by the ale-taster.' These officials had to take the following oath:—'You are chosen ale-tasters of this town. You shall well and truly serve his Majesty and this town, in the same office. You shall at all times try, taste and assize the beer and ale to be put to sale in this liberty, whether the same be wholesome for man's body, and present those that offend, or refuse to suffer you to assay it. You shall give your attendance at all courts, and present from time to time the offenders, and all things else belonging to your office you shall do and execute. So help you God.' The records do not tell us whether the 'prejudice' question was raised in those days. This practice of 'ale-testing' is still in existence in some places at the present time. For instance, we read in a contemporary that at the annual court leet of the Earl Bathurst at Cirencester the other day, Messrs. Harding and Kitton, the 'ale-tasters,' asked to be relieved from their office, on the ground that they were getting old men, and wished someone else to take their places. They handed in a certificate which set forth that the 'ale and beer has been better this year than last, and they consider it to be in fair condition,' &c. They stated that they had held their office for two years, and during that period they declared they had done their duty as 'ale-tasters' most conscientiously. This being the case, and the ale being so good, Messrs. Harding and Kitton were reappointed. *We are disposed to think that the quality and purity of beer would be quite as well sustained by such 'ale-tasters' as by the system of local inspectors, analysts, and others, provided for in recent Acts of Parliament.*"

No doubt, Mr. *Brewer*, you would like to return to the middle ages, and so be able to "improve" your beer and to make it agreeable to the palate, without the interference of such an impertinent and obtrusive science as chemistry, to tell the public how you do it. We thank our friend for his capital little piece of ingenuousness.

So as to show the superiority of the old processes adopted by the "ale-tasters," we give a curious piece of information, which we once came across while reading up ancient food customs in the Library of the British Museum. It seems, that in common with most persons, the "ale-tasters" wore leather breeches, and when they went to test the ale for the presence of sugar, a pint of the fluid was spilt upon a well-cleaned bench, and the taster sat upon the same till it dried. If on rising, the leather continuations stuck to the bench, then sugar was present, but if not, the beer was pure. This is a specimen of the ancient accuracy of manipulation, to which the *Brewers' Guardian* would fain return!

Our readers will peruse with interest the paper by Mr. Thomson, on the peculiar ferment produced in yolk of egg by the morbid growth of bioplasm. We sincerely hope that the New Year will not only prove a happy and prosperous one to our subscribers, but also a scientifically profitable one, during which, they will each turn their attention to some point in the analysis of food and drugs, and by sending us their results, advance the great sanitary cause in which we are all fellow-workers. Many a little makes a muckle, says the Scotch proverb, and no new light thrown on any process, but will find welcome to our columns.

We wonder what can have been the state of mind of that student who, at a recent examination at one of our hospitals, in answer to the question, "Explain the difference between the chemical and physical properties of matter, and give one or two examples in illustration," gave the following gem of an answer:—"The differences between these two properties of matter are, I may venture to say, enumerable (*sic*); first, one possesses life, *heat*, organs, structure, and various others; the other is lifeless, without heat or organs, structureless. Another difference is in the appearance. Example:—Animals a mere composition—live in a higher state—of physical matter presents a most striking contrast to water, though the same chemical elements which enter into the combination of water forms by far the greater part of animal composition."

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
1761	H. J. Haddan	Treating Wool, Silk. &c.	2d.
1800	J. Holden	Receptacles for Storing Liquids	4d.
1855	M. M. Prager	Manufacture of Leaven or Yeast	4d.
1874	F. J. Cheesborough	Manufacture of Sulphate of Lime	4d.
1889	A. R. Molison	Lighting Gas Jets by Electricity	2d.
1894	H. E. Newton	Dyeing Animal Substances	2d.
1904	J. F. Farquhar and J. B. Macfarlane	Treatment and Purification of Sugar	6d.
1943	W. Browne	Manufacture of Silicate Cotton Cloth	6d.
2052	C. Graham	Effecting the Fermentation of Solutions Capable of Yielding Alcohol	6d.
2106	R. Martin	Manufacture of Gas	6d.
3250	H. Wilde	Producing and Regulating Electric Light	6d.
3804	J. F. Bailey	Speaking Telephones	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Examiner; The Medical Times and Gazette; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Anti-Adulteration Review; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; Bayley's Chemist's Pocket Book; The House Surgeon, or the Doctor at Home; Manual of Practical Chemistry, by A. W. Blyth.

THE ANALYST.

FEBRUARY, 1879.

SOCIETY OF PUBLIC ANALYSTS.

THE ANNUAL MEETING of this Society was held on Wednesday, the 15th January at Burlington House, Piccadilly, Dr. Dupré, F.R.S., in the chair.

The minutes of the previous meeting were read and confirmed.

The Treasurer presented the accounts for the year, audited, and expressed his satisfaction at the financial position of the Society, as compared with last year.

Dr. Bostock Hill and Mr. A. Ashby, were appointed Scrutineers to examine the voting papers, and they reported that the following gentlemen had been elected as President, and Vice-presidents, &c., for the present year.

President.

J. MUTER, PH.D., M.A., F.C.S.

Vice-Presidents.

A. DUPRE', PH.D., F.R.S., F.C.S.
J. W. TRIPE, M.D.
J. C. BROWN, D.Sc., F.C.S.

Treasurer.

C. W. HEATON, F.C.S.

Hon. Secretaries.

CHARLES HEISCH, F.C.S.
G. W. WIGNER, F.C.S.

Other Members of Council.

M. A. ADAMS, F.R.C.S.
A. H. ALLEN, F.C.S.
A. WYNTER BLYTH, M.R.C.S., F.C.S.
A. H. CHURCH, M.A., F.C.S.
A. HILL, M.D., F.C.S.
E. W. T. JONES, F.C.S.
F. MAXWELL LYTE, F.C.S.
C. H. PIESSE, F.C.S.
W. C. YOUNG, F.C.S.

Those Members of Council whose term of office has not yet expired, and who do not retire this year, are C. A. Cameron, M.D.; H. C. Bartlett, Ph.D., F.C.S.

The Scrutineers also reported that Mr. J. Baker Edwards, Ph.D, F.C.S., Public Analyst for the District of Montreal, Canada, and Mr. R. G. Fraser, Public Analyst for the District of Halifax, Canada, had been elected Members of the Society.

Dr. Dupré then read his valedictory address, as follows:—

When, two years ago, you did me the honour of electing me your President, the fortunes of our Society were at a very low ebb, our numbers were not increasing, and our finances were in anything but a satisfactory condition. Now, thanks mainly to the exertions of one of our secretaries, Mr. Wigner, our condition is very materially improved. Our darkest days are, I believe, over, for the present at least, and I can vacate this chair in favour of my successor, with the pleasing conviction that he will begin his term of office under more favourable conditions than obtained two years ago.

We have now 90 members and 10 associates, 17 members and 1 associate having been elected during the year. On the other hand, we have unfortunately lost three members by death, namely, W. Baker, E. H. Jones, and J. Wiggin; one member has resigned and one has been struck off. One associate has also resigned.

The number of papers read at our meetings or contributed by members to THE

ANALYST also show an increase, having been 35 last year against 33 the previous year. As regards our finances, we have now a balance of £13 in hand, whereas at this time last year we were in debt to the amount of £10. All this is highly satisfactory, and I trust we may continue in the same path.

The Society has now been established about four years, and although it may be too early, as yet, to affirm that it has proved its claim to permanent existence, we may at least say, without fear of contradiction, that it has done much good and useful work during that time. Indeed, had our Society not existed, it is not too much to say that the Sale of Food and Drugs' Act could not have been worked with anything like the success it has been. Not only has our Society disseminated among its members the knowledge of processes (old as well as new), devised by chemists in every part of Europe and America, but the contributions of our members to the branch of practical chemistry relating to the testing of foods, drinks, and drugs, are among the most valuable that have been made to that branch of chemistry during the last four years. Much, however, still remains to be done before our means of grappling with what might be called the art of adulteration, can be said to rest on a thoroughly satisfactory basis, and until such is the case a Society like ours is, I believe, a necessity. We may, therefore, confidently look forward to, at least, a number of years of useful and prosperous existence.

When the Society was first established many of the public analysts that had been appointed were, without doubt, less acquainted with the duties they were called upon to perform than was at all desirable, but this was almost unavoidable. The study of processes adapted for the detection of adulteration in foods and drinks had been very greatly neglected, and I believe there was not a single public laboratory in the country in which such processes were taught. Every public analyst had, therefore, to study such processes by himself as occasions arose, in many cases after his appointment. Now, however, this state of things has in very great measure passed away, thanks mainly to the labours of our Society, and public analysts form, on the whole, as efficient a body of men, for the performance of the special duties cast upon them, as could reasonably be expected.

We have, of course, not escaped serious criticism and even abuse, more particularly at the hands of interested trade journals, but this need not be wondered at. The business of our members is to render adulteration impossible, and all engaged in the nefarious work of adulteration, be they milk dealers, grocers, or pharmaceutical chemists, will, of course, cry out against us. Fair criticism, even if very severe, is useful, and ought to be encouraged and welcomed, but, unfortunately, much of the criticism we have been exposed to has been the reverse of fair, though often very strong. One very common misrepresentation I would take this opportunity of denouncing most emphatically. Public analysts are often abused as prosecutors, as if they not only analysed the samples brought to them, but bought them and acted as prosecutors as well. Now, nothing can be further from the truth. The public analyst, as we all know, and as anybody might learn, neither buys the samples, nor, in the majority of cases, even suggests what samples are to be bought, and he has absolutely nothing whatever to do with the prosecution. All he does is to analyse the samples brought to him, and to give a certificate in accordance with the results of his analysis. He does not know from whom the samples have been bought, as they are merely distinguished by a number or other mark, and he cannot, therefore, by any possibility, be biassed one way or the other.

During the past year there have been rather fewer differences between public analysts, on the one hand, and the Somerset House Chemists—the chosen court of referees—on the other. This is probably, in part at least, owing to the more careful work of public analysts in general, but in greater part, I believe, it is due to the fact that the referees are gradually learning the new work cast upon them by the Sale of Food and Drugs' Act, even as public analysts had to learn theirs. In time, no doubt, substantial agreement will be arrived at, and such time would be materially shortened if the authorities at Somerset House were to instruct their chemists fairly to meet the wishes of this Society, as expressed in the letter of the Secretaries of 22nd January, 1878. As it is, our proceedings being public, all analytical processes used by our members, as well as the various standards, or rather limits, adopted or proposed by our Society, often after much discussion, and representing always a very considerable amount of experience, are open to anybody to challenge or disprove. But our conclusions thus publicly arrived at may be overridden, because a small number of experiments, deemed by the few chemists at Somerset House to be conclusive, are apparently not in accord with our conclusions, but instead of bringing these alleged facts forward for general discussion, they keep them in the drawers of the Somerset House Laboratory, to be brought forward only when some public analyst has to be proved wrong. Such a state of things is eminently unsatisfactory. A court of referees to appeal to in disputed cases, is perhaps a necessity, and at all events is highly desirable, but all the factors with which it works should be open to the fullest discussion, otherwise it is impossible for those affected by its decisions to have confidence in its competency. It is no doubt true that anyone who goes to the Somerset House Laboratory is shown, with the greatest politeness, the various analytical results on which reliance is placed. But facts so obtained are, by the very manner in which they are obtained, beyond the pale of public discussion, and it is impossible to criticise them. The present referees seem also often to forget that it is their primary duty to protect the public against the nefarious practices of the adulterating manufacturer or tradesman.

A serious interruption to the working of the Act was caused last year in various districts in England, owing to the fact that many magistrates recognised as a valid defence the plea that an inspector cannot be said to be prejudiced if he receives an adulterated article. Had this plea been universally recognised, the Sale of Food and Drugs' Act would have been a dead letter. The case will soon be argued before one of the higher courts, and the decision to be pronounced will, no doubt, set the point at rest, either by refusing to recognise the validity of the plea, when, of course, everything will go on as heretofore, or by recognising it, compel Parliament to pass a short amending Act.

Another interesting case will also shortly be heard, on appeal from one of the magistrates in my district, namely, whether, in selling an entirely fictitious article (artificial butter in this case), it is sufficient for the dealer to wrap the article in a paper, on which is printed, in somewhat small type, and not in a conspicuous place, "Notice, this compound is sold as imported and declared according to the Act section 8," without any intimation to the buyer that he is not obtaining what he asked for. It is to be hoped that Mr. Woolrych's decision will be upheld.

A somewhat striking case, showing the importance of continuous supervision, which has come under my own observation, may not be un-interesting to many. By the direction of the District Board nine samples of milk were bought one Sunday morning, and brought to me for analysis. Out of these nine samples two only were fairly good while seven were largely adulterated, two of them consisting of milk and water, in about equal proportions. A fortnight later, nine more samples were bought, but by this time the dealers had taken the alarm, and one sample only was found adulterated. Taking the average for the last two or three years, rather less than one in five has been found adulterated, but these were always bought on week-days, and the above was the first Sunday experiment.

Before vacating this chair, I would once more earnestly entreat all our members to aid in the general usefulness of the Society, by bringing as much as possible of their work, as Public Analysts, before our meetings. It is not to be expected that many of our members can spare the necessary time for elaborating new processes of analysis, but everyone, without exception, can aid in the improvements of already established methods, by bringing forward his personal experience, and let nobody think that his experience may not be worth publication. Every observed fact is of value, and it is only by the co-operation of many that any great advance can be made. Even if no entirely new fact can be brought forward, much good might be done if members generally would favour us with some of the results of their yearly work, giving us, say, the compositions of the various *pure* articles they have examined during the year. We should then, as a Society, soon be in possession of a series of chemical statistics relating to all kinds of food, drink and drugs, which would be invaluable to all engaged in their examination—such a series as could not be matched anywhere.

And now, it only remains for me to thank you once more most heartily for the honour you did me in electing me your President; the occupation of this chair has been to me a great pleasure, and I trust that it may not have been without some benefit to the Society.

Dr. Muter then moved "That this Society desires to express its hearty thanks to the "retiring president, Dr. Dupré, for the marked ability and courtesy with which he "has uniformly conducted the business of the Society," and in doing so alluded to the able and temperate way in which Dr. Dupré had always managed the meetings, and the great chemical knowledge and skill shown in the remarks he made on the various papers read before the Society.

Mr. Heisch seconded the resolution, which was carried unanimously.

Dr. Dupré having briefly replied,

Mr. Hehner proposed, and Dr. Bostock Hill seconded, "That the thanks of this "Society be presented to the Officers and Members of Council for their attention to the "business of the Society during the past year."

Mr. Heaton returned thanks.

Dr. Dupré proposed, and Dr. Alfred Hill seconded, "That this Society desires to "express its hearty thanks to the Council of the Chemical Society for the gratuitous use "of their rooms for general and council meetings during the past year," and the Secretaries were directed to transmit a copy of the resolution to the Council of the Chemical Society.

Dr. Dupré then vacated the chair, which was thereupon taken by

Dr. Muter, who, in returning thanks for being elected to that seat, said he felt very unworthy of the honour, but trusted that his attention to the interests of the Society would be such as to make him worthy of it.

Mr. O. Hehner read a paper "On the determination of Phosphoric Acid as Phospho-molybdate," and Mr. Allen and Dr. Muter joined in the discussion which *ensued.*

Mr. Wigner read a paper by Mr. E. W. T. Jones, "On the influence of the Decomposition in Butters from age on the Specific Gravity of the Fat, and the percentage, of Soluble and Insoluble Acids," and also a paper by Dr. J. M. Milne, "On Butter Analysis."[*]

As there were several Members who desired to make some remarks on the subject, the discussion on these papers was adjourned until the February Meeting.

After the meeting the Annual Dinner was held at the Café Royal, Regent Street, when the members and several friends passed a very agreeable evening.

The next Meeting of the Society will be held on February 19th, at Burlington House.

ON THE DETERMINATION OF PHOSPHORIC ACID AS PHOSPHO-MOLYBDATE.

By Otto Hehner, F.C.S.

Read before the Society of Public Analysts, on 15th January, 1879.

In bringing this communication before the Society of Public Analysts I am well aware that the subject has already been treated of by several chemists, and I also bear in mind that the method of determining phosphoric acid as phosphate of magnesia is an excellent one when performed under the conditions and with the precautions which have been worked out of late years. Yet the precipitate of phospho-molybdate of ammonia is a particularly tempting one to found upon it a method for the quantitative determination of phosphoric acid, since it contains, in combination with a very small quantity of phosphoric acid, an exceedingly large proportion of molybdic acid and other constituents; and because it is but very little soluble, and can be precipitated from acid media.

Molybdic acid has long been employed both for the detection and for the separation of phosphoric acid for quantitative purposes, especially from such bases as are precipitated by ammonia or by phosphoric acid. But owing to the alleged variable composition of the precipitate it has not hitherto been utilised with any measure of success for the direct determination of P_2O_5, although several attempts have been made.

In going into this matter I have carefully perused everything accessible to me which has been written on the subject, and I will as briefly as possible give a list of the more important papers treating on it.

Svanberg and Struve (Jahresb, 1847, p. 412) first made the observation, that molybdate of ammonia produces a yellow colouration or precipitate in the presence of phosphoric acid. They did not, however, recognise that the P_2O_5 was an essential constituent of the precipitate, to which they assigned the formula $(NH_4)_2O$, $5 MoO_3 + H_2O$.

It was Sonnenschein (Jahresb, 1851, p. 349) who first proved that the P_2O_5 was a normal constituent, and he utilised the precipitate for the quantitative determination of the P_2O_5, and essentially his method is still employed at the present time. It consists in the precipitation of the P_2O_5 in concentrated solution, by an acid solution of MoO_3 washing the precipitate with dilute molbydic solution, dissolving it in ammonia, and, precipitating the P_2O_5 by means of magnesia mixture. According to Sonneaschein the precipitate contains 3 per cent of P_2O_5.

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[*] Owing to the pressure on our space this month we are compelled to hold over these papers until our next number.

According to Nutzinger (Jahresb, 1855, p. 374) the composition of the dried precipitate (at 100°C) is 3·82 per cent. P_2O_5, and 92·70 per cent. MoO_3. Seligsohn (Journ. f. Pract. Chem., vol. 67, p. 470) shows, in a very careful examination, that the precipitate dried at 100°C contains 3·142 per cent. P_2O_5, 90·744 MoO_3, 3·570 $(NH_4)_2O$ and 2·544 H_2O. He assigns to it the formula $2\ (3(NH_4)_2O,\ P_2O_5) + 15\ (H_2O,\ 4\ MoO_3)$.

Sopp (Pogg. Annal. 109, p. 136) finds 3·20 P_2O_5, 86·0 MoO_3, 5·91 $(NH_4)_2O$ and 4·91 H_2O. He first attempted the direct determination of the P_2O_5 by *measuring* the precipitate in graduated tubes.

Lipowitz (Ibid) explains the variable composition of the precipitate, as apparent from the varying statements quoted above, by saying that MoO_3 is invariably mixed with the phospho compound, and he therefore prepares a molybdic solution, by the addition of tartaric acid to Sonnenschein's solution, and boiling, which would not deposit free MoO_3. He collected the precipitate on a weighed filter, washed with dilute HNO_3 and dried over oil of vitroil. He states the average amount of P_2O_5 in the precipitate to be 3·607 per cent. Even if this way of procedure were capable of furnishing accurate results it would be quite impracticable, on account of the drying over H_2SO_4 it entails. Tartrates, moreover, act most inimically to the complete precipitation of the P_2O_5, more so than any other salts.

Boussingault, however, asserts, without proof, as far as I can ascertain, that P_2O_5 can be more correctly determined by the direct weighing of the phospho-molybdate precipitate than by conversion into the magnesia compound. When this statement was made the magnesia method was certainly far from perfect. According to Boussingault the precipitate contained 3·73 per cent. of P_2O_5.

Eggerts (Journ. Pract. Chem., 1860, p. 498) finds in the precipitate dried at 95°C 3·74 per cent. P_2O_5. He states that when dried above that temperature decomposition takes place, with the probable formation of pyrophosphate. He washes the precipitate with water to which 1 per cent. of NHO_3 has been added and dries at 95°C, or measures the precipitate in a narrow tube.

He asserts, that the precipitate is never crystalline, even when viewed with high powers of the microscope, and he also states that with 0·0017 P_2O_5 in 15 c.c. of water 4 c.c. of molybdic solution produce no precipitate. Both these statements, as well as his solubility determinations given below, are erroneous.

Rammelsberg, (Berl. Ber., 1877, p. 1776) finds in the dried precipitate (at 100°C) 3·90 per cent. P_2O_5, 86.45 per cent. MoO_3, 3·25 $(NH_4)_2O$, and 5·77 H_2O.

Apart from other and less reliable statements we have therefore in the yellow precipitate, according to

Nutzinger	3·82 per cent. P^2O_5
Seligsohn	3·14 "
Sopp	3·20 "
Lipowitz...	3·61 "
Boussingault	3·73 "
Rammelsberg	3·90 "
Eggerts	3·74 "

Or 1 part of P_2O_5 furnishes from 25·64 to 31·84 parts of yellow precipitate.

I had practically completed my investigation when I noticed in one of the most recent numbers of the Berl. Berichte that Finkener had worked out a method such as I had in view. I shall have occasion to refer to it further on.

My object then was to find out the reason for that variation in the composition of the precipitate, and to study, if possible, the conditions under which it could be obtained of constant composition.

On examining a very large number of phospho-molybdate precipitates obtained in the ordinary course of analysis, by means of the microscope, I very often discovered side by side with the yellow and distinct crystals of the phospho compound colourless acicular crystals of molybdic acid, and I have therefore no doubt that Lipowitz's explanation is correct. The quantity of the MoO_3 crystals is the larger the higher the temperature at which the precipitate is obtained. I may mention that phospho-molybdate crystallizes, usually, in very distinct but minute and almost granular crystals, apparently belonging to the hexagonal system; but sometimes beautiful six-rayed stars of great regularity are obtained.

In all of my experiments I precipitated at the lowest possible temperature, at most 30 or 35°C. I avoided all excess of acid, especially of free H Cl, neutralising it, as far possible, with NH_3.

The molybdic solution employed was prepared according to Fresenius, namely, by dissolving 1 part of molybdic acid in 4 parts of ammonia of 0 96 sp. gr., and pouring the solution thus obtained slowly into 15 parts of HNO_3 of 1·2 sp. gr., avoiding all rise of temperature. This solution contains 5 per cent. of molybdic acid. It may be warmed, indeed, almost boiled, both in its concentrated state or when diluted, for many hours, without depositing any MoO_3.

I determined not to weigh the precipitate directly, as had hitherto been done, but to dissolve it in ammonia, to evaporate this solution and to ascertain the weight of the residue. I thus avoided the clumsy and troublesome scraping out of the precipitate from the beaker, to which, as a rule, it clings most obstinately, and substituted for that operation one involving practically no risk of loss. I also obviated the collection on a weighed filter. Thus I really weighed (at least in my earlier experiments) a mixture of molybdate of ammonia and of phosphate of ammonia, thus decreasing still further the proportion of the P_2O_5 in the substance.

It is plain that I could not employ for the washing of the precipitate the usual acid liquid containing molybdate of ammonia, but was obliged to remove all acids, and, indeed, all soluble matter. But it is stated that the yellow precipitate is soluble to some extent in any of the menstrua which were thus left to me, notably in water and in alcohol. Besides, I found, that on washing with water, the precipitate almost invariably ran through the filter as soon as all acid had been removed.

According to Eggerts 1 part of the precipitate is soluble in 10,000 parts of water, in 6,600 parts of 1 per cent. nitric acid and in 620 of alcohol of 0·80 sp. gr.

I digested some of the yellow precipitate, which had been shown by the microscope to be free from crystals of molybdic acid, with water, alcohol of 90 per cent. and alcohol of 45 per cent., for some weeks, shaking frequently. The temperature during that time varied, but was, when I ultimately filtered, about 14°C. I found one part of the precipitate to require for solution of

Water	21,186 parts.
Strong Alcohol	8,117 ,,
Dilute Alcohol	13,513 ,,

Since about 28 parts of the precipitate contain 1 part of P_2O_5, no less than 593,200 parts of water, or 378,000 parts of dilute alcohol, are necessary to dissolve 1 part of P_2O_5 in that form. Or assuming that 100 c.c. of water or dilute alcohol were employed for washing a precipitate, and usually a smaller quantity would suffice, no more than 0·00017 or 0·00026 grm. P_2O_5 respectively could be dissolved, assuming that by filtration alone a saturated solution could be obtained, which is undoubtedly *not* the case. The solubility of the yellow precipitate in water or dilute alcohol may therefore be safely disregarded, and my experiments will show that no influence whatever can be traced to the employment of these liquids.

I prefer to use dilute alcohol, because with it the precipitate is not apt to go through the filter, at least not when the latter is of a sufficiently close and tight texture.

I prepared a dilute solution of phosphate of soda, and determined in it, as carefully as possible, the amount of phosphoric acid, both by evaporation and by precipitation with chloride of magnesium mixture. I have entirely discarded sulphate of magnesia mixture, because absolutely exact results cannot be obtained when it is used, as has been shown over and over again—(see Abesser, Jani and Märcker, Zeitschr. f. Anal. Chem., 1873, p. 243; Fresenius' Quantitative Analysis, 6th edition, p. 403, etc.)—the results being as a rule *too high.*

Exp. 1. 50 c.c. phosphate solution gave 0 0215 pyrophosphate of soda, containing 0·01147 grm. P_2O_5.

Exp. 2. 50 c.c. furnished 0·0213 pyrophosphate of soda or 0·01136 grm. P_2O_5.

Exp. 3. 50 c.c. precipitated with magnesium mixture yielded 0·0184 grm. $Mg_2P_2O_7$ = 0·01176 P_2O_5.

Exp. 4. Obtained from 50 c.c. 0·0182 grm. $Mg_2P_2O_7$ containing 0·01164 grm. P_2O_5.

The P_2O_5 found fluctuated therefore from 0·01136 to 0·01176, the average being 0·0115 P_2O_5 in 50 c.c.

Exp. 5. 50 c.c. were concentrated to about 20 c.c., and precipitated, at a temperature of about 30 with 60 c.c. molybdate solution. After 10 hours the precipitate was separated by filtration, washed with alcohol, care being taken to pour as little as possible of the precipitate upon the filter, dissolved in NH_3 and the solution evaporated, the solution being kept strongly alkaline to the very end of the evaporation. The residue was dried at 100°C until the two last weighings agreed within 1 Mgrm. Obtained 0·3435 grms. residue, or 1 part of P_2O_5 yielded 29·87 parts residue.

Exp. 6. As above. Obtained 0·3426 residue, 1 P_2O_5 therefore gave 29·79 parts residue.

Exp. 7. As above. Obtained 0·3536 residue, 1 P_2O_5 = 30·75 parts residue.

Exp. 8. As above. 25 c.c. of alcohol were used for washing. Obtained 0·3549 residue, or 1 P_2O_5 = 30·86 residue.

Exp. 9. As above. 50 c.c. of alcohol used for washing. Residue weighed 0·3543 grms. or 1 P_2O_5 =30.81.

Exp. 10. As before. 100 c.c. alcohol used for washing. Residue 0·3487; or 30·32 residue from 1 P_2O_5.

Exp. 11. 100 c.c. phosphate solution evaporated to about one half, and precipitated with 75 c.c. molybdic solution. Result 0·6877 residue, or 1 P_2O_5 =29·90 parts residue.

Exp. 12. 100 c.c. phosphate solution, precipitated without concentrating it first, with 75 c.c. molybdic solution. 0·6971 grm. residue. 1 P_2O_5 =30·31 residue.

Exp. 13. 25 c.c. phosphate solution, 25 molybdic solution and 25 c.c. dilute nitric acid, yielded 0·1741 residue, or 30·28 residue from 1 P_2O_5.

Exp. 14. 2 c.c. phosphate, containing no more than 0·00046 P_2O_5, 50 c.c. water, and 10 c.c. MoO_3 solution gave 0.0141 grm. residue or 30·65 parts from 1 P_2O_5.

In all these cases, I took care not to allow the bulk of the liquid to become too small, as by concentration MoO_3 would become precipitated. I obtained, on the average, from 1 part of phosphoric acid 30·35 parts of residue, or 100 parts of residue contain

3·295 of P_2O_5. Dividing the quantities of residue obtained by 30·35, we obtain the following amounts of phosphoric acid :—

		Taken.		Found.
5	... ...	0·0115	...	0·0113
6	... ...	0 0115	...	0·0113
7	... ...	0·0115	...	0·0116
8	... ...	0·0115	...	0 0117
9	... ...	0·0115	...	0·0117
10	... ...	0·0115	...	0·0115
11	... ...	0.0230	...	0·0227
12	... ...	0·0230	...	0·0230
13	... .	0·00575	...	0·0057
14	... ...	0·00046	...	0·00046

It will be observed, that without adopting any special precautions against admixture of MoO_3 with the yellow precipitate taking place, except avoiding high temperatures or great contentration, very tolerably constant results were obtained, more constant in fact, than could have been yielded by the magnesia process.

The following experiments however will show clearly that the process as hitherto used by me was somewhat defective.

A solution was made of 1.9763 grm. of a phosphorite in 250 c.c. after due separation of the silica.

Exp. 15. 50 c.c. were precipitated, and the phosphomolybdate washed with alcohol until nitrate of silver solution proved the complete absence of chlorine; obtained 2·5625 grm. residue. Divided by 30·35 this indicates 0·0844 $P_2 O_5$. The residue dissolved in NH_3 and the solution precipitated with Mg. mixture gave 0·1376 $Mg_2 P_2 O_7 = 0·0880 P_2 O_5$.

Exp. 16. 50 c.c. precipitated as above, with addition of 25 c.c. dilute HNO_3; obtained 2·5283 grm. residue, or 0·0833 $P_2 O_5$. From this residue 0·1367 $Mg_2 P_2 O_7$ were obtained, containing 0·0874 $P_2 O_5$.

Exp. 17. 10 c.c. phosphate solution, 10 c.c. dilute HNO_3 and 25 c.c. molybdic solution gave 0·5375 grm. residue, or 0·0177 $P_2 O_5$; or from 50 c.c. 0·0885 $P_2 O_5$.

Exp. 18. 10 c.c. phosphate, 10 c.c. diluted HNO_3, 25 c.c. water and 25 c.c. molybdic solution gave 0.5378 residue, containing (divided by 30·35) 0·0177 $P_2 O_5$ (or from 50 c.c. 0·0885 $P_2 O^5$)

		Obtained therefore—	
Taken.		$P_2 O_5$ calculated from $Mg_2 P_2 O_7$.	$P_2 O_5$ in 50 c.c. calculated from Residue.
50 c.c.	...	0·0880	0·0844
50 c.c.	...	0·0874	0·0833
10 c.c.	...	—	0·0885
10 c.c.	...	—	0·0885

Two of these four determinations are therefore unsatisfactory, whilst two, those in which but 10 c.c. phosphate solution were employed, agree well with the phosphate of magnesia determinations. In further experiments I found a similar difference. On investigation I noticed that the residues obtained from smaller quantities are always perfectly soluble in water, showing that they really consisted of molybdate of ammonia and of phosphate of ammonia, whilst in cases where I employed a large quantity of phosphoric acid the residue was not entirely soluble in water, a separation of an insoluble molybdate of ammonia and loss of ammonia having taken place, although the solution during evaporation had been kept strongly ammoniacal.

I therefore abandoned the plan of weighing, what I may, for brevity's sake, call an ammoniacal residue, so liable to decomposition, and converted it, by repeated evaporation with small quantities of water to dryness, into what I will call an aqueous residue, incapable of losing by drying any further quantity of ammonia, and consisting of phosphate of ammonia and of an acid molybdate of ammonia. This kind of residue moreover has the advantage of drying most rapidly to weight absolutely constant. I found that I had to divide the aqueous residue by 28·5 in order to obtain the amount of P_2O_5 contained in it.

2·1932 grammes of a sample of superphosphate were dissolved and the solution made up to 250 c.c.

Exp. 19. 50 c.c. were precipitated and the precipitate after dissolving in NH_3 converted into $Mg_2P_2O_7$, obtained 0·0908 $Mg_2P_2O_7$, or 0·0581 P_2O_5, or from 10 c.c. 0·0117 P_2O_5.

Exp. 20. 10 c.c. were precipitated with 20 c.c. MoO_3 solution, and the ammoniacal residue prepared. This amounted to 0·3532 grm., or 0·0116 P^2O_5.

Exp. 21. 10 c.c. phosphate solution, 10 c.c. HNO_3 and 30 c.c. MoO_3 solution yielded 0·3519 grm. ammoniacal residue = 0·0116 P_2O_5.

Exp. 22. 10 c.c. phosphate solution, 20 c.c. HNO_3 and 40 c.c. MoO^3 solution gave ammoniacal residue 0·3525 grm. = 0·0116 P_2O_5.

Exp. 23. 10 c.c. precipitated with 25 c.c. molybdate; aqueous residue 0·3405, divided by 28·5 = 0·0119 P_2O_5. It was dissolved in ammonia and the solution precipitated with magnesia mixture. 0·0183 $Mg_2P_2O_7$ resulted = 0·0117 P_2O_5.

Exp. 24. Same quantities taken as before. Aqueous residue 0·3350 grm. $\frac{1}{28\cdot5}$ = 0·0117 P_2O_5. It yielded 0·0186 grm. $Mg_2P_2O_7$ or 0·0119 P_2O_5.

Exp. 25. Quantities as before. Aqueous residue 0·3347 = 0·0117 P_2O_5. This gave 0·0184 $Mg_2P_2O_7$ or 0·0118 P_2O_5.

Exp. 26. 10 c.c. phosphate solution, 50 c.c. water, 25 c.c. molybdic solution, yielded aqueous residue 0·3322, or 0·0116 P^2O_5. This furnished 0·0179 $Mg_2P_2O_7$ or 0·0114 P_2O_5.

Exp. 27. 10 c.c. phosphate, 10 c.c. dilute HNO_3, and 25 molybdic solution gave 0·3194 aqueous residue = 0·0112 P^2O_5. From it 0·0177 $Mg_2P_2O_7$ or 0·0113 P_2O_5.

Tabulated, these results are as follows:—

	P_2O_5 calculated from $Mg_2P_2O_7$.	P^2O_5 from aqueous residue.
10 c.c. phosphate	0·0117	—
”	0·0117	0·0119
”	0·0119	0·0115
”	0·0118	0·0117
”	0·0114	0·0116
”	0·0113	0·0112
Average	0·0116	0·0116

Solution of another phosphorite, 2·5151 grms. per 250 c.c.

Exp. 28. 10 c.c. phosphate and 20 c.c. solution of another phosphate, 2·5151 grms. per 260 c.c. molybdic solution yielded 0·6308 grm. aqueous residue or 0.0221 P_2O_5. Converted into phosphate of magnesia, it furnished 0·0335 $Mg_2P^2O_7$, or 0·0214 P_2O_5.

Exp. 29. 10 c.c. phosphate, 10 c.c. of a 20 per cent. nitrate of ammonia solution, and 20 c.c. molybdic solution yielded 0·6442 aqueous residue, equal to 0.0226 P_2O_5, this furnished 0·0353 $Mg_2P_2O_7$ or 0·0226 P_2O_5.

Exp. 30. Same as 29. Aqueous residue 0·6360=0·0223 P_2O^5. From this 0·0349 $Mg_2P_2O_7$ equal to 0·0223 P_2O_5.

Exp. 31. 10 c.c. precipitated with an excess of molybdic solution, the precipitate washed with 20 per cent. NH^4NO_3, and then dissolved in NH_3 and straight converted into magnesia precipitate. Obtained 0·0346 $Mg^2P_2O_7$ = 0·0221 P_2O_5.

Exp. 32. 10 c.c. phosphate, 20 c.c. molybdate. Residue 0·6197 equal to 0·0218 P_2O_5. This furnished 0·0349 $Mg^2P^2O^7$ or 0·0222 P_2O_5.

Exp. 33. 10 c.c. phosphate solution, 25 c.c. molybdate. Residue weighed 0·6452 grms. = 0·0226 P^2O_5. From it $Mg^2P^2O_7$ 0·0361 grms. = 0·0231 P_2O_5.

Exp. 34. 50 c.c. phosphate solution were precipitated with 125 molybdic solution, the precipitate washed with 20 per cent. NH^4NO_3, dissolved in NH_3, and the solution at once precipitate with magnesia mixture. Obtained 0·1707 grm. $Mg^2P_2O_7$ containing 0·1092 grm. P_2O_5, or from 10 c.c. phosphate solution 0·0218 grm. P_2O_5.

Exp. 35. 50 c.c. were precipitated as above, the precipitate washed with alcohol (dilute). Obtained 3·1807 grm. aqueous residue, or 0.1116 P^2O_5, or from 10 c.c. 0 0223. This residue dissolved in NH_3 furnished 0·1719 grm. $Mg_2P_2O_7$ or 0·1099 P_2O_5 from 10 c.c. therefore 0 0220 P_2O_5.

Exp. 36. 1 c.c. of the phosphate solution were mixed with 10 c.c. $NH_4 NO_3$, and precipitated with 5 c.c. MoO_3 solution. Aqueous residue 0·0692 or 0·0024 $P_2 O_5$ instead of 0·00223.

Thus the results are—

	$P_2 O_5$ calculated from $Mg^2 P^2 O_7$.	$P_2 O_5$ calculated from aqueous residue.
10 c.c. phosphate solution ...	0·0214	0·0221
" " ...	0·0226	0·0226
" " ...	0·0223	0·0223
" " ...	0·0221	—
" " ...	0·0222	0·0218
" " ...	0·0231	0·0226
" " ...	0·0218	—
" " ...	0·0220	0·0223
Average ...	0·0222	0·0223

These results are, I may safely say, highly satisfactory. They speak to the accuracy both of the magnesia method and of the molybdic method. The latter is, however, far less troublesome, requiring less labour, time and attention than the precipitation as phosphate of magnesia and ammonia. The precipitation does not take longer than two or three hours, and hence a determination of phosphoric acid can readily be completed within a day.

The expense of the molybdic acid is trifling, and it is a very simple matter to recover it from the solutions obtained on filtering the yellow precipitate and on dissolving the aqueous residue, after weighing. I prefer to work up the molybdic residue as follows:—I render the solution acid, if not already so, by means of nitric acid, add phosphate of soda, and heat; collect the precipitate, wash it superficially, dissolve in NH_3 and precipitate the $P_2 O_5$ by means of magnesia mixture. The filtrate is made slightly acid with nitric acid, when molybdic acid at once separates, is collected on a filter, washed and dried.

I will now refer, in a few words, to the method recently proposed by Finkener, alluded to above (Berl. Ber. 13, 1878). I became acquainted with it only after I had practically completed my investigation as detailed in this paper.

Finkener states that the yellow precipitate can readily be obtained of constant composition, *provided* there is always a sufficient quantity of free nitric acid, that at least one third of the total MoO_3 taken remains in solution after precipitation of the phosphoric acid, and that 100 c.c. of the liquid contains no less than 25 grm. $NH_4 NO_3$. He washes with a 20 per cent. solution of $NH_4 NO_3$ slightly acid with HNO_3, then with a little water removes the precipitate, partly by washing, partly by dissolving in ammonia with a porcelain basin, concentrates, adds HNO_3, evaporates and by careful heating drives off the nitrate of ammonia. The residue thus obtained contains 3.794 per cent. $P_2 O_5$ ($1 P_2 O_5 = 26·36$ parts residue.)

To this is to be remarked that his precautions for obtaining a precipitate of constant composition are quite superfluous and clumsy. For although there is no doubt that nitrate of ammonia greatly increases the delicacy of the molybdic reaction, it evidently produces separation of molybdic acid or of a molybdate of ammonia. For according to Richters (Dingl. Polyt. Journ., Vol. 199, p. 183) the precipitates produced in liquids containing much $NH_4 NO_3$ *differ* from those obtained under ordinary circumstances *by their greater bulk and their lighter colour*. Furthermore, on heating the residue to get rid of the nitrate of ammonia, reduction of the molybdic acid always takes place, and I obtained whenever I followed Finkener's instructions, a residue dissolving in NH_3 with a dark blue colour, showing the presence of molybdic oxyde.

REVIEWS.

PRACTICAL CHEMISTRY.*

THIS is an extremely useful handbook, containing a large amount of carefully collected and well arranged information on the analysis of the principal articles of diet in daily use, and the detection and estimation of organic and inorganic poisons. The author has, of course, drawn largely from the published works of others, but he has followed, or we might almost say, set an example which might well be used more generally, by giving at the end of each chapter a list of the works consulted and from which the information has been partly drawn. By this means he affords a valuable opportunity for estimating the importance to be attached to those determinations or statements which appear to differ to any extent from those ordinarily accepted.

A very small amount of space is devoted to the ordinary laboratory manipulations, and this is certainly an advantage, for it is monotonous to read in handbook after handbook full instructions for carrying out processes which are supposed to have been learnt even by a junior student in a laboratory.

In the classification of the starches and directions for the microscopical examination, the author has followed closely the instructions laid down in Muter's *Organic Materia Medica.* The chapter on sugar is well and carefully written, and is one of the first cases in which we have seen the polariscopic estimation of sugar by the more recent optical method fully and accurately described.

In reference to wheat, bread and flour all the most recent researches are referred to, and the only thing we can see to regret is, that a method proposed by Wanklyn for the determination of gluten by means of alkaline and permanganate solution should have been referred to as a fairly accurate one, for, after all, such a process as this can only by any possibility yield a small percentage of the total nitrogen present.

As to milk and butter the author has availed himself freely of all recent papers that have been written on the subjects, and the chapters contain a very complete compendium of nearly all that is now known on the matter.

Tea, coffee and cocoa are treated very fully, and there are, perhaps, a larger number of original analyses than are to be found in any other book of the same class.

The chapters on alcohols, wines and beers are complete, and contain not only the necessary instructions for their ordinary analysis, but also the tables of original gravities; and in the case of wines, a reprint of Gautier's tables for the detection of the colouring matters which have been added.

The latter half of the book is devoted entirely to the detection and estimation of poisons, and a good deal of care has evidently been taken to arrange this matter in such a systematic and consecutive form that it should be handy for reference. We think the author has been very successful in his attempts in this direction, and all those who are occasionally troubled with difficult and tedious examinations for poisons will find the book of value.

THE LOCAL GOVERNMENT BOARD REPORT.

THE seventh report recently issued devotes about five pages to the work done by public analysts under the Sale of Food Act, and these contain a good deal that is interesting to analysts generally. During the year ending March, 1878, to which the report refers, 27 additional appointments of analysts were made, and up to that time the appointments then existing were as follows :—Counties, 42 ; boroughs, 72 ; district boards and vestries in the metropolis, 39 ; total, 153. The Board have recently addressed communications to all authorities who had not appointed analysts, and they note with satisfaction that many of those have since complied, or are complying, with the provisions of the Act. The Board point out as noteworthy that, "in several English counties, and in the greater part of Wales, no analyses whatever have been made, and the counties of Buckingham, Essex, Kent, Oxford and Suffolk have, together, only furnished 30 samples." This is precisely the same information, and is conveyed in almost the same words that we used when we drew the attention of the public to the matter in the early part of 1877, and again in 1878, and the same remark will have to be made year after year until compliance with the Act is made compulsory. It is scarcely likely that a number of men interested in commerce—many of them in retail commerce—will, themselves, put a penal Act of this kind in motion. The tabulated statement of the description and number of samples analysed during the year is fairly concordant with that we have already published, allowing for the fact that there is three months difference between the dates of the commencement and close of the two tables. The remarkable fact again comes to the front that drugs are considerably more adulterated than the average of all other samples, and that, in fact, if we exclude spirits, the adulteration of drugs is 25 per cent. of that of all other samples taken together. This does not seem a very creditable state of things for chemists and druggists, and we can scarcely wonder that the opinion of the Board should be expressed in such terms as the following :—"We regret that a larger number of samples of drugs have not been submitted to analysis ; it is obvious that the use of adulterated drugs may defeat the intentions of the physician, and that the consequences may be exceedingly serious. Of the samples examined, more than one-fifth are reported against, and some of them were far below the standard of the British Pharmacopœa. There was one case in which suspicion was aroused by the death of two dogs, to which medicine bought as jalap had been administered, and an analysis showed that two-thirds of the so-called jalap consisted of strychnine." It is worth while to note that the number of samples of drugs examined, which the Board regret as insufficient, was larger than the number of samples of spirits other than gin , nearly as large as the number of samples of beer, and about 80 per cent. of the number of samples of flour, so that on the whole it appears that drugs were fairly looked into.

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* *A Manual of Practical Chemistry. The Analysis of Foods and the Detection of Poisons.* By A. Wynter Blyth, M.R.C.S., F.C.S. C. Griffin & Co., 1879.

As to the dilution of spirits, the Board state they are aware that dissatisfaction has arisen as to the working of the Act, and that they have received petitions on the subject, but they sum up the matter by saying "it does not appear to us that any alteration of the law is necessary to meet this case ; there is no reason why a publican should not sell a mixture of gin and water, provided that he does not sell the mixture as gin, *which it certainly is not*."

The total number of samples included in the returns for the year is 14,706, of which 2,826, or 19·2 per cent. were adulterated.

The results of the examination of tea in bond show that out of 662 samples one chest was destroyed as unfit for food, 7 samples, representing 1,578 packages, were still under detention, and 36 samples, representing 10,491 packages, were allowed to be exported, *i.e.*, we presume they were considered too bad for consumption by civilized Englishmen, and so were sent out to the barbarians. Mr. J. B. Keene, the analyst concludes his report by saying that with one exception, the whole of the teas that were detained were from China, and the chief objection was the presence of exhausted leaves.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

CANE SUGAR IN MILK.

To the Editor of "The Analyst."

Sir,—In the current number of The Analyst Mr. J. H. Collins has given an interesting account of a case of adulteration of milk with cane sugar. I ask him, in the interests of all public analysts, to publish full details of his methods of analysis, for I confess that I am puzzled by Mr. Collins' figures, and do not see how he has made out that the milk he speaks of was adulterated with 20 per cent. of a solution of cane sugar having the same specific gravity as ordinary milk.

A solution of cane sugar of the specific gravity of ordinary milk (*i.e.*, 1·030) contains 7·44 per cent. sugar (7·65 grammes in 100 c.c.). If a milk containing 3·2 per cent. fat, 9·3 per cent. solids not fat, and 12·5 per cent. total solids, were mixed with a solution of cane sugar of specific gravity 1·030, in the proportion of 80 gallons of milk to 20 gallons of the sugar solution, we should get the following figures, which I compare with Mr. Collins' milk.

	Sugared milk.	Mr. Collins' milk.
Fat	2·40	3·00
Solids not fat	9·03	9·37
Total solids	11·43	12·37

Mr. Collins' figures lead to the following composition of the original milk, on the assumption that 80 gallons of milk were mixed with 20 gallons solution of cane sugar :—

Fat	3·75
Solids not fat	7·84
Total solids	11·59

It appears to me that the sophistication of milk with a solution of cane sugar presents considerable difficulties: the use of a solution of the density of milk would materially diminish the amount of total solids in the milk; whilst the use of a solution of sugar containing the same percentage of solids as milk would materially raise the specific gravity of this fluid. It is difficult to reconcile Mr. Collins' analysis with his conclusions. I also demur entirely to his statement that the whey of a milk sophisticated with syrup may be easily tested for cane sugar by dividing a measured quantity into two parts, inverting the sugar in one half by sulphuric acid, and titrating both with Fehling's solution. Fehling has stated (Ann. Pharm. 106, 79) that it is impossible to estimate milk sugar accurately by his solution without first converting the lactin into dextrose, and the widely discrepant statements published respecting the quantity of copper that a molecule of milk sugar reduces bear out this statement. Doubtless Mr. Collins has better evidence to advance than that already published of the sophistication of the milk in question, but he will serve the interests of public analysts by publishing that evidence.

Yours, &c ,

Guy's Hospital, *January 15th*, 1879.

THOS. STEVENSON.

ALUM IN FLOUR.

To the Editor of "The Analyst."

Sir,—So much has been written about the detection of alum in flour, by the logwood test, that I feel somewhat reluctant to add to the bulk of matter. When I tried the value of the test for my own edification, I carried out some experiments, which at the time, I thought scarce worth recording. As the results throw some additional light upon the risk of failure in the use of the logwood test for alum in flour, and the reason of such failure is not exactly rendered apparent, I will ask space to make the following observations.

One would have thought that since the publication of the note, "On the Detection of Alum in Flour," by Mr. Carter Bell, in the *Analyst*,* (which seems to be ignored by recent observers) no more would be heard of the fallacious character of the logwood test.

Under the impression that the baking of the bread rendered the alumina insoluble, and that this was necessary to ensure the success of the test, I took some flour purposely alumnised, and moistened it with baryta water, and, on adding an ammoniacal solution of logwood, obtained no indication of alum. I afterwards tried lime water, a solution of chloride of barium, and chloride of calcium with similar results but on mixing the alumnised flour with water (by mistake), and then adding baryta water, the logwood solution alone, or the ammoniacal solution produced the blue colour. I subsequently found that the addition of the chemical compounds enumerated did not interfere with the production of the blue colour, which was produced when the flour was moistened with water. The results obtained, were, however, not always the same, and I noticed that the stronger the alcoholic solution of logwood was, the more risk of failure, and when absolute alcohol was employed, even if the flour had been mixed into a stiff paste with water, no blue colour appeared. I found that this was due to the insolubility of alum in alcohol, hence the failure of the experiment. I then tried an aqueous solution of logwood, and noticed that it was infinitely preferable to the alcoholic solution for detecting alum in *flour*, and it has never failed to indicate the presence of alum throughout my experience. I take a *small* quantity of flour and rub it up well in a glass mortar with a *dilute* aqueous solution of logwood, to which a few drops of carbonate of ammonia solution have been added. The solution of logwood should only be slightly darker in colour than a saturated solution of bichromate of potash, and it should be added in sufficient quantity to convert the flour into a very thin paste.

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* Vol. 2, p. 28.

I am, &c.,

CARDIFF, *January* 15*th*, 1879.

J. W. THOMAS.

To THE EDITOR OF "THE ANALYST."

SIR,—The interest still felt respecting the question of alum in flour has, I observe, again brought the subject to the surface; and I take the opportunity of bringing to the notice of your readers a matter which may have some influence on the views of some persons, who look on the subject in a somewhat exaggerated way.

Twenty-five or twenty-six years ago the practice of adding alum to flour by the corn millers was very common, at least I may say it was so in this district. Several prosecutions were instituted in which I was professionally concerned. Under an old Act of Parliament, search, under a Magistrate's Warrant, can be made by a constable, and this authority was exercised in some of the cases I allude to. It was then discovered that those who practised this art, had special machinery for doing it, namely, a kind of mill fixed in the top part of the building, which ground the alum at a certain rate, and distributed it by means of spouts or conductors into the hopper or other receptacle of the wheat, and was ground with it by the stones. This method, I apprehend, is still pursued whenever the adulteration is practised by the miller. The idea that the alum could be distributed with sufficient regularity by the hand of a workman in a large mill is untenable. Another erroneous notion that appears to have taken possession of some minds, is that small doses of 3 or 4 grains of alum to a pound of flour would be of any use, or that it would be worth anybody's trouble putting such small quantities in. Judging from what now and then appears in print there is a deal to unlearn on this subject.

F. M. RIMMINGTON.

BRADFORD, *January* 14*th*, 1879.

ANALYSTS' REPORTS.

The County Analyst (Mr. J. H. Collins) having reported to the Cornwall Epiphany Sessions that no samples had been submitted to him for analysis, owing to several recent cases being dismissed on technical grounds, the Chairman said the Court would have to take this matter into consideration. The magistrates who dismissed the cases in question only upheld, as they were bound to do, the decision of a superior Court. The recent decision of Lord Chief Justice Cockburn had virtually annulled the Act.

The public analyst for the County of Durham (Mr. A. J. M. Edger of Newcastle) reports that he has analysed 106 samples of food and drugs during the quarter ending December 31st, 1878, viz.:—67 of milk, 13 of butter, 8 of lard, 2 of oatmeal, 2 of cheese, 2 of flour, 3 of pepper, 1 of vinegar, 1 of sago, 7 of cream of tartar—and found 20 to be adulterated and 9 of inferior quality. The adulterated articles were—9 of milk, with amounts of added water varying from 5 to 33 per cent.; 2 of butter, one being composed entirely of fat other than butter, and 1 having an excessive quantity of water; 1 of lard, with 8·63 per cent. of water; 1 of oatmeal, with 15 per cent. of barley; 7 of cream of tartar, with sulphate of barytes, silica, bicarbonate of soda, and excessive quantities of tartrate of lime.

"PROOF SPIRIT."—"Proof Spirit" was so called because in the pre-scientific age it was customary to levy duty on spirits by a rough and ready process, called the proof, and conducted as follows:—A small heap of gunpowder was wetted with the spirit to be tested, and the wet spirit was then set alight. If the spirit was strong the gunpowder became ignited and flashed off very soon after the spirit was lighted; but if the spirit was weak, the water left behind it as it burned off wetted the gunpowder so that it did not explode. A careful investigation of the true constitution of the spirit showed that the weakest spirit capable of igniting the powder had the following composition by weight:—alcohol, 49·24; water, 50·76; specific gravity, 920. This is known as proof spirit.

THE SALE OF FOOD ACT.—At the Quarter Sessions held at Lancaster on the 30th December, the Chairman referred to the fact that in several cases of adulteration magistrates had declined to convict under the Food and Drugs' Act, on the ground that they did not consider the sale to a police superintendent was to the prejudice of the purchaser; and, after drawing attention to an opinion recently expressed by the Local Government Board upon the subject, said he had no doubt the Act would be set right in the next session, and in the meantime he hoped that magistrates would convict in all such cases proved before them for, if they did not, guilty persons would escape, and the public would be imposed upon. Mr. Fell alluded to the difficulties often experienced by magistrates in dealing with cases of selling adulterated spirits, and he proposed—"That in any Act which may be brought into Parliament in the next session to amend the Sale of Food and Drugs' Act, this Court is of opinion that the standard of spirits should be actually defined, and that a copy of this resolution be transmitted to the Secretary of State." Mr. Starkie, M.P., seconded, and the motion was carried.

LAW REPORTS.

Adulterated Milk.—Thomas Robinson, dairyman, was summoned for selling adulterated milk. Mr. E. Bell defended. Mr. Supt. Marley stated that on the 21st December last he went to the Union Workhouse, where Mr. Robinson's serving-man supplied milk. Witness purchased a pint of milk from the man, the milk was quite warm when he obtained it, which was some time after it had been taken from the cow. The analyst's certificate was produced, and showed that the milk was adulterated by the addition of at least 8 per cent. of water. Mr. Bell stated that the milk in question was obtained by defendant from the Cleveland Dairy Company. The Chairman explained from what occurred previously, they were of opinion that the Cleveland Company respectably conducted their business. Mr. Bell, in asking the Bench to deal leniently with the defendant, said that he had had the contract for the Workhouse for the last twelve or thirteen years, and had never had the slightest fault found with him, and the milk complained of was not his own. The Bench, having regard to the position defendant occupied as a wholesale dealer, fined him 40s. and 8s. 6d. costs.

At Westminster, J. Foy, butterman and cheesemonger, of 30, Regency Street, Westminster, was summoned under 38 and 39 Vic., cap. 63, sec. 6, for selling an article not of the nature, substance, and quality demanded by the purchaser. Mr. Warrington Rogers prosecuted on behalf of the Westminster District Board of Works; Mr. St. John Wontner defended. Thomas Lightfoot, the inspector of the Board, deposed that on the 16th Dec. he purchased at the shop of the defendant half a pound of butter, paying 8d. for it. He told the woman who served him that it was for the purpose of analysis and offered her part of it. She then called his attention to a printed notice on the paper—"This compound is sold as imported, and declared according to the Act, section 8." He then asked if they had any "pure butter," and the woman said "No," but there was a placard in the window which set forth that "new grass butter was now on sale." He left the shop and submitted the sample for analysis. The analysis of Dr. Dupré, of Westminster Hospital, was then put in, and ran thus:—"Only slightly flavoured with butter, and consists almost entirely of fat other than butter fat, probably beef or mutton fat." It was not injurious to health. In answer to further questions, witness said that on the same day he purchased nine samples at the same price and seven of them were genuine. Mr. Wontner submitted that the defendant clearly came within the exemption of the 8th section, which enacted that no person should be guilty of any offence under the Act if at the time of the delivery of the article he should supply to the purchaser a notice, written or printed, to the effect that the article was a mixture. In this case the defendant had done so. The importation of butter into this country was very great, and some persons preferred a mixture to pure butter. The words of the section enacted that the giving of the label should protect the seller where the mixture was not injurious to health, or there was no intention to fraudulently increase the weight, bulk, or measure. He cited the case of "Pope, appellant, and Turle, respondent" (43 *Law Journal*, Common Pleas, Magistrates' case, p. 129), May 28, 1874. The justices of Bedford had dismissed a summons for selling adulterated mustard, and the complaining person asked for the opinion of the Court above. It was stated in the case that at the time the respondent delivered the mustard to the appellant he said "I do not sell you this as pure mustard," and at the same time called attention to the label on the canister, "Warranted free from injurious admixtures, but not sold as pure mustard." On analysis the mustard was found to be mixed with wheaten flour and tumeric. The justices were divided in opinion as to the words of the 3rd section of 35 and 36 Vic., cap. 74, "and who shall not declare such admixture to any purchaser thereof," one being of opinion that sufficient notice had been given, and the other that the seller should declare what the actual admixture was—*i.e.*, set out the component parts. That was the issue before Lord Coleridge, Mr. Justice Brett, and Mr. Justice Grove. They were undivided in their opinion that the selller was entitled to their judgment on the ground that he did declare to the purchaser that the mustard was mixed with some other ingredient, and, even had he not, he could not come within the 2nd section (which he must to incur the penalty), because if the admixture was such as to make it an adulterated article within the meaning of the 3rd section, still he did not sell it as an unadulterated article. He was not, therefore, within either section. The next case in support of his argument was not "reported," but appeared in *The Times* of June 8, 1875. This was also in the Common Pleas. ("Gibson v. Leaper.") It was a "case stated" by the Justices of Spalding, under 35 and 36 Vic., cap. 74, sections 2 and 3. Appellant was a grocer at Spalding, and sold a quarter of pound of Epps' cocoa without making any verbal statement as to its contents, but on the face of the packet were the words, "Prepared cocoa; for ingredients see the other side," and on the "other side" was a notification to the effect that it was necessary, to make the oil in the cocoa soluble and easy of digestion, to combine with it arrowroot and sugar, and such were the component parts of the packet. On analysis this was found to be substantially correct, but the Justices convicted the appellant. The Court quashed the conviction, holding that assuming the cocoa to be adulterated, it had not been sold as unadulterated. The mere handing of the packet did not constitute a complete sale, because it was open to the purchaser to reject it if it did not correspond with what he had asked for. Therefore, whether it was true or not that a mixture was necessary to make cocoa edible, this article could not be said to have been sold as "unadulterated." Now, *in the present case*, the inspector could have rejected the article if he thought fit. Mr. Wontner then, having referred to the vexed question now pending in the superior Courts as to the "prejudice of the purchaser," Sir James Ingham having held that the inspector was not a *bona fide* "purchaser," contended that the word "compound" on this packet of butter was synonymous with "mixture," and signified something consisting of various ingredients necessary to make the whole. The inspector would certainly have been prejudiced had he got pure butter, for then he would have received an article he did not expect to get, for he went with the intention of not purchasing a genuine article. Then, again, this was an imported article and sold by the defendant as bought, so that it was not like a case where a man added to the bulk and adulterated it. The defendant had not the chance of proceeding against the person who sold it him, as the purchase had been made at an open market. Mr. Wontner contended, in fine, no offence had been committed under the Act, and the defendant was exempt under the 8th section. Mr. Woolrych, having recapitulated the facts and the heads of the defence, referred to the words, to the "prejudice of the purchaser." In his opinion, the objection was unfounded, and the inspector, purchasing an article under the provisions in section 13, was prejudiced within the meaning of section 6, to whatever purposes he may have intended to apply the article; that he obtained an inferior commodity, having paid the price of a genuine article; that the offence contemplated by the 6th section was complete on the delivery of the impure article to the purchaser, and that the prejudice described followed as a legal consequence. That appeared to him to result from the combined operations of the several sections referred to, and any other combination would defeat the provisions of the Act. He should act upon that opinion until, if erroneous, it should be corrected by the decision of a superior Court. With regard to the effect of the printed notice as a defence, he was of opinion, even assuming the notice to be, in point of form, in accordance with the section, the facts did not bring the case within the exception relied on. That only constituted a defence and exonerated the seller in the case of an article mixed with a matter or ingredient not intended fraudulently to increase its weight, bulk, or measure. The facts here, in his opinion, showed that the mixture was intended to produce the fraudulent increase described in the section. That being so, the notice would confer no protection, and it became therefore, unnecessary to inquire whether the notice was in point of form a good one, on which the question might be raised whether the term "compound" (a word used in other parts of the Act) was equivalent to the word "mixture," used in this section. He thought it became unnecessary to consider as to the notice not having been brought to the attention of the purchaser until after a complete sale and delivery, as required by the enactment; also that the facts of the case showed the fraudulent intent described; and the grounds on which he arrived at that conclusion were that the officer saw a printed notice that the "best grass butter" was served in the shop; that, paying the price of a genuine article, he was supplied with a commodity designated as butter, but having little or none of that article in its composition, and that for the same price he obtained genuine butter at other shops. On the whole of these facts, he considered the defence failed, and the defendant would be fined £3 and costs. Mr. Wontner asked for a "case," which Mr. Woolrych at once granted.—*Times*.

SELLING ADULTERATED MILK.—Hannah Dunnan, milk seller, was summoned under the Food and Drugs' Act for selling adulterated milk.—Superintendent Marley deposed that he went to defendant's house at Stranton and saw her supplying milk from a bowl. He asked defendant for a pint, which he received, and divided into three parts. The Certificate from Mr. Edger, County Analyst, was produced from which it appeared that the milk was adulterated by the addition of not less than 33 per cent. of water. Defendant denied selling "one sup" of the milk from which the samples were taken. Supt. Marley said this was untrue, as he obtained it in exactly the same manner, and from the same utensil as that from which the defendant was supplying her customers. Defendant also stated that she told the Superintendent that the milk he obtained for his sample was intended for a calf.—Supt. Marley stated this remark had reference to another can of milk. The Chairman, on behalf of the Bench, reminded the defendant that she had previously had several narrow escapes, having upset the cans of milk when the officers put in an appearance, but this did not influence their decision. The maximum penalty was £20, but they would this time only fine her £3 and costs.

John Brazell, dairyman, Lamb Street, was summoned for a similar offence. Supt. Marley gave evidence respecting the purchase of milk from a quantity with which customers were being supplied. The County Analyst's certificate showed that the milk was adulterated by the addition of not less than 17 per cent. of water. Defendant was not present, and the service of the summons having been proved, defendant was fined 40s. and costs.

John Reed, of Middleton was summoned for a like offence. The milk in this case was adulterated with at least 16 per cent. of added water. Defendant stated that he was supplied with the milk by Mr. Robinson, of California, and their agreement was that the milk should be pure. The Chairman stated that perhaps Mr. Robinson would compensate the defendant for the loss sustained owing to the impurity of the milk. Supt. Marley explained that a sample of Mr. Robinson's milk was still at the County analyst's, witness having obtained it as soon as he found the source from which defendant had his supply. Defendant was fined and costs, and the Chairman thought that defendant could have his remedy by process in the County Court.

George Hanley, grocer, Melbourne, was summoned for selling adulterated coffee, contrary to the Food and Drugs' Act. Mr. Supt. Wood purchased a quarter of a pound of coffee at the defendant's shop. He informed the defendant that it was to be analysed, and gave him proper notice. The analysis showed that there were 82 parts of pure coffee and 18 parts of chicory. The coffee was not labelled. The defendant alleged that he did not know that the coffee was adulterated. He sold it as he had bought it. He was fined 1s. and the costs. He was further summoned for selling adulterated mustard to Mr. Wood who bought a quarter of a pound from the defendant. The analysis showed that there was 87 per cent. of mustard, with 13 per cent. of wheat flour and a little turmeric. Fined 9s. and costs.—Thomas Nichols, grocer, Barmby Moor, was summoned for selling adulterated coffee. Mr. Wood bought a quarter of a pound of coffee, and told the defendant that it would be analysed. The analysis showed that the coffee contained two parts of coffee and one of chicory. The defendant stated that he had sold it as he had bought it. It was not sold to him as a mixture. Fine 1s. and costs—He was further summoned for selling to Mr. Wood a quarter of a pound of adulterated mustard. The analysis showed that there were 70 per cent. of mustard, 30 per cent. of wheat flour, some farina, and a little tumeric. Fine 1s. and costs. William Hoggard, grocer, Wilberfoss, was summoned for selling to Mr. Wood three ounces of sweet nitre which was adulterated. The analysis showed that there was 33 per cent. of water, and that it was practically of no use as a medicine. The defendant said he had sold it as he had purchased it. He was fined 1s. and costs.

Sweet Nitre.—George H. Myers, druggist and grocer, Welton, was charged at the Welton Petty Sessions, by Superintendent Ellerker with selling a certain drug, viz., sweet nitre, which was not of the substance and quality demanded. The Superintendent stated that he visited defendant's shop and purchased 3 oz. of sweet nitre. It was divided into three parts—one sent to the analyst, one detained by witness, and one by defendant, each being sealed. The report of the analyst was as under :—"The above should be 52 degrees over proof, whereas it is only 15·3, thus showing the presence of about 24 per cent. of water above the standard. It contains the proper per centage of nitrous ether, and it is not rendered useless as a medicine by being of great alcoholic strength. 17th Dec., 1878. Jas. Baynes."—Defendant said he was quite ignorant that the sweet nitre he sold was not of the proper quality. It was sold by him as purchased from a most respectable firm in Hull.—The Chairman (W. H. Broadley, M.P.) said so far as it was their duty they were determined to carry out the Act that the purchasers should have what they expected they were purchasing. Fine and costs £1 9s. 6d.

Adulterated Whiskey.—A case was investigated at Bridgewater, lately, in which a publican was charged with selling adulterated whisky. The case was adjourned from the previous court, when Mr. Stoddart, the county analyst, certified that the sample was not that of ordinary whisky, but was entirely composed of plain raw green spirit, commonly called spirits of wine, lowered by thirty per cent. of water. For the defence another certificate was put in from Mr. Dugald Campbell, London, stating that the sample was genuine whisky. The case was adjourned in order that the samples might be analysed by the Crown officers at Somerset House.

Adulterated Milk.—Frederick R. Winn, a cowkeeper of Manor-street, Clapham, was summoned for selling milk mixed with water, to the prejudice of the purchaser, Mr. Smith. Mr. Corsellius, clerk of the Wandsworth Board of Works, who attended in support of the summons, produced the certificate of the analyst, stating that the milk was adulterated with 18 per cent. of water.—The inspector having proved the purchase of the milk from a boy in the street, the defendant said he sent out the milk in the same state as he received it.—Mr. Paget fined him 40s. with 12s. 6d. costs.

The Name but not the Article.—Elizabeth Crawford, shop-keeper, Seaton Carew, was summoned for infringing the Food and Drugs Act.—Mr. Bell defended.—A pound of butter was purchased by the police-officer from defendant, and a sample forwarded to the county analyst, Mr. A. M. Edger, whose observations on the certificate were as follows.—"This does not contain a particle of butter. It is entirely composed of fats other than butter."—Mr. Bell admitted the offence, but stated that his client purchased it from a wholesale merchant, and had not the slightest knowledge as to its composition, otherwise she would not have sold it. Defendant had no guarantee from the merchant.—Defendant said that she purchased 36-lb. of the material as butter, at 1s. 2d. per pound, and produced her invoice.—The Bench considered that the invoice was a sufficient guarantee that the stuff was sold as butter by the merchant, and, therefore, dismissed the case against Mrs. Crawford; also ordering the remainder of the grease to be impounded.

The question of employing Mr. Comyns Leach as public analyst for the borough of Dorchester was discussed at the meeting of the Town Council on Tuesday last. It appeared that Mr. Leach offered to fulfil the duties for an annual salary of £10 and the 10s. 6d. fee for each analysis. Mr. George, of Dorchester, asked £20 a year and the fee. The Mayor and other members commented on the advantage of having a resident analyst, and were in favour of the appointment of Mr. George; but ultimately the matter was postponed. At Weymouth it is proposed to appoint Mr. Leach.

A Curious Informality.—A Chester grocer, who was summoned for adulteration of coffee, got off on Saturday before the county magistrates through a curious informality. The county analyst reported, "Sample adulterated with 20 per cent. of vegetable matter, which I believe to be chicory." The chairman (the Rev. R. Richardson) said it it was nonsense for Mr. Carter Bell to say he could not tell if the added matter was chicory or not. The case must be dismissed.—*Liverpool Courier*.

Chlorophylle.—There have recently been many prosecutions under the provisions of the Sale of Food Act, for selling green peas coloured with copper, &c., it being alleged that the use of such colouring matter was decidedly injurious to the health of the consumer. Having this fact in view, M. Guillemare Professor of Chemistry, and M. Lecourt, manufacturer of conserves, at Paris, were struck with the advantage of substituting "chlorophylle" (a vegetable substance) for the colouring of green peas, &c. and we are pleased to say that their efforts in this direction have been quite successful. After many experiments these gentlemen have succeeded in definitely fixing "chlorophylle" on vegetables by adding it to that which they naturally possess, thus preserving the green colour which otherwise would be destroyed by ebullition—an operation which is necessary to insure preservation. Besides its simplicity this process presents the immense advantage of not introducing any injurious agent into the preserved vegetables, as the products employed enter into one's daily food. Consumers may thus place on the table, in the middle of winter, without fear of injury to health, or extra expense, vegetables admirable green and of excellent taste. The Académie de Sciences of Paris has reported most favourably on the process; and vegetables treated with Chlorophylle have been analysed by several English chemists with equally favourable results. Dr. Saunders, public analyst for the City, having examined samples, writes:— "The peas had a green colour and a good flavour. They were entirely free from copper or anything that would be injurious to the health of those using them as an article of food." We consider the new process of colouring preserved vegetables a very important one, a great improvement on anything brought out before and its success is exceedingly satisfactory.—*Grocer*.

NOTES OF THE MONTH.

Our readers will feel much interest in the recent decision by Mr. Woolrych at Westminster, to the effect that a vaguely-worded printed slip, to the effect that "this compound is sold as imported and declared according to the Act, section 8," is not sufficient notice to the purchaser under that section. A case has been applied for, and we anxiously await a decision of the supreme court on the point. It is quite clear that the use of such formulæ lies in their effect of blinding the public to the true state of the case, and hence the value to the sellers. The Act intended that nothing should be sold in a mixed state, unless the ingredients of the mixture be clearly stated (as is done on the cocoa packets of all the great makers), and we hope that the court of appeal will see the thing in this light, and insist on *butterine* being sold as avowedly imitation butter prepared from animal fat. Nobody could then for a moment object to the article which, as now turned out, is wholesome, and even somewhat palatable.

Once more that wretched analyst, who only lives to persecute honest men! What do you think he has been doing now? Actually he has had the audacity to report exactly according to the requirements of the Act, and so our dear friend the *Chemist and Druggist* once more deservedly shows him up. Why does he not give, in his quarterly reports, the results of convictions? What does it matter that he has no power to order, or responsibility in carrying out, prosecutions, seeing that it is his clear duty to break the requirements of the Act, and interfere with the province of the local authorities? Poor analyst, when can he ever do right? He is charged with initiating all proceedings, and when he distinctly shows that it is not his business, he is taunted with not reporting the result of the work of others. We despair of ever satisfying the *Chemist and Druggist;* to him an analyst, no matter how spotless, is but a red rag thrown before a bull, and he gores the rag when he cannot get at the individual. After all what is it but the true spirit of the colliery districts, as exhibited in the famous dialogue;—"Who's that?"—"Stranger."—"Let's heave half a brick at him!" and so our friend goes on heaving his bricks, which luckily fall softly, and break on our backs. It amuses him, and it does not hurt us, so *vive la bagatelle!*

One is always meeting those who are complaining of the want of "harmony" among analytical chemists, but had they been at the annual dinner of our society, they would have found harmony reign supreme. Even grave and potent members of the "Institute" unbent themselves, and lent their songs and stories to keep up the jollity. One member was heard to exclaim, under the potent influence of "Heidsieck," that, "after all, there was more to be gained from F.I.Z. than from F.I.C—both were costly and purely luxuries, but the former was really the more satisfying." *In vino veritas.*

Mr. Comyns Leach has been appointed Public Analyst for the County of Dorset, and also for the Borough of Poole.

Dr. W. Morgan has been appointed Public Analyst for the County of Pembroke.

Mr. R. H. Ridout has been appointed Public Analyst for the Borough of Monmouth, *vice* E. H. Jones deceased.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
2130	S. Pitt	Manufacture of Carbonate of Soda	4d.
2182	F. Wirth	Manufacturing Phosphoric Acid and Super-Phosphate	4d.
2221	"	Manufacture of Phosphate of Potassa or Phosphate of soda	2d.
2519	"	Manufacture of Pyroxyline and Nitro-Cellulose	4d.
2203	E. W. Parnell, and J. Simpson	Manufacture of Caustic Alkalies	6d.
2211	H. H. Murdoch	Refining of Sugar	4d.
2231	C. W. Heaton	Purifying Gas	6d.
2308	W. Hollman	Obtaining Vegetable Charcoal	2d.
2397	W. R. Lake	Carburetting Gas	2d.
2401	B. Dubos	Apparatus for producing Electric Light	2d.
2489	T. Redwood	Manufacture of Gas	4d.
3022	A. Allhusen	Manufacture of Soda	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Anti-Adulteration Review; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; American New Remedies.

THE ANALYST.

MARCH, 1879.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting was held at Burlington House, Piccadilly, on the 19th inst., the President, Dr. Muter, M.A., F.C.S., in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. Adams and Mr. Hehner were appointed Scrutineers, and reported that Mr. Sidney Harvey, Public Analyst for Canterbury, Margate, &c., and Mr. Alfred Smetham, Analytical Chemist, Liverpool, had been elected members.

Professor F. A. H. La Rue, M.A., M.D., of Quebec, Canada, was proposed for election, and will be balloted for at the next meeting.

The discussion on the papers on "Butter Analysis," read at the previous meeting, was then resumed by Dr. Dupré and Mr. Hehner, and concluded by Dr. Muter.

Mr. Hehner read a paper "On Condensed Milk," and a paper "On the Analysis of Coffee Leaves," in the discussion on which several members joined.

Mr. Wigner read a paper by Dr. Cameron, "On the Falsifications of Milk."

The next Meeting of the Society of Public Analysts will be held at Burlington House, on Wednesday, March 19th, at eight o'clock, and among the papers to be read will be one by Dr. Dupré "On Violet Powder."

INFLUENCE OF THE DECOMPOSITION OF BUTTERS FROM AGE ON THE SPECIFIC GRAVITY OF THE FAT, AND THE PERCENTAGE OF SOLUBLE AND INSOLUBLE ACIDS.

By E. W. T. Jones, F.C.S.

Read before the Society of Public Analysts on 15th January, 1879.

In January 1877 I made some analytical experiments on pure butters, the results being communicated to the Society of Public Analysts in March of that year, and afterwards published in The Analyst.* The remaining portions, wrapped in paper, of nine samples, A to I inclusive (J was all used), were put into an open glass vessel, and left in a room connected with my laboratories until July last, when they were reached down for analysis, to show the effect of eighteen months' keeping, practically exposed to air and light; each one of the samples, as can be imagined, was thoroughly rancid, yea more, almost stinking. Some of each sample was carefully melted and filtered, to separate water, curd, &c., and the specific gravity of the fat and the soluble and insoluble acids taken in exactly the same way as when the first analyses were made. I append the results alongside those obtained when the butters were fresh.

	A		B		C	
Specific Gravity of the Fat at 100° F.	912·3	908·3	910·5	911·4	911·9	918·5
Soluble Acids ...	4·84	3·81	3·76	4·07	5·12	6·02
Insoluble Acids ...	89·00	90·13	90·44	89·69	88·86	87·09

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* Vol. II. p. 19.

	D		E		F	
Specific Gravity of the Fat at 100° F.	911·2	916·5	912·5	915·5	913·3	913·2
Soluble Acids ...	4·50	5·45	5·51	5·47	5·44	4·31
Insoluble Acids ...	89·80	87·41	88·64	87·20	88·11	88·06

	G		H		I	
Specific Gravity of the Fat at 100° F.	913·3	912·4	912·2	915·6	913·5	907·7
Soluble Acids ..	5·69	4·92	5·19	5·32	4·69	3·32
Insoluble Acids ...	88·32	88·29	88·79	86·81	89·46	90·35

It will be observed that in five samples out of the nine that the specific gravity and the percentage of soluble acids has increased, and the insoluble acids decreased; in one F, the specific gravity is nearly the same, but the soluble acids decreased, whilst in the remaining three, A, G, I, the specific gravity and the percentage of soluble acids have fallen, with, of course, an increase of insoluble acids.

These butters were all submitted to the same condition of keeping, hence the difference in degree and character of the changes must be due to the constitution of the butters themselves, and the varying amount of casein, water, salt, &c.

To the public analyst the most important point to notice is that the specific gravity test is seriously affected by the decomposition from keeping, whilst the amounts of soluble and insoluble acids have not been so much altered as to prevent a fairly reliable opinion as to genuineness.

Another matter of interest is the small amount of acidity, calculated as butyric acid, extractable by agitating a small portion of the *butter* (not filtered fat) with *hot* water. After removal of the fat the acidity was taken by decinormal soda. The percentages are upon the butter (not fat).

A	B	C	D	E	F	G	H	I
0·19	0·17	0·35	0·27	0·42	0·40	0·11	0·27	0·38

NOTES ON THE ANALYSIS OF BUTTER.

By J. M. Milne, Ph.D.

Read before the Society of Public Analysts, on 15th January, 1879.

Having lately had occasion to examine some samples of butter, and having made a number of experiments in connection therewith, it may not be out of place to bring the results obtained under the notice of the Society.

Though these notes contain nothing essentially new, still as the present process for butter analysis is of comparatively recent date, I think it is well that as many as possible of the results obtained by different analysts should be published; and, furthermore, there are one or two little modifications which I have found useful, and which may possibly be of advantage to others.

The process employed was the modification of Muter's original method, described by Jones, in The Analyst.* The standard solutions we made as there directed; but latterly, instead of decinormal soda, as recommended by him, the semi-normal soda used for nitrogen determinations was employed, and found to give quite as accurate results, and, of course, obviating the necessity of multiplying standard solutions.

I can bear testimony to the ease with which the butter-fat can be saponified *com-*

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* Vol. II., p. 19.

pletely, on the top of an ordinary water oven, when the flask and its contents are pretty frequently shaken, and provided not much more than five grams of the fat are used for each experiment. As a means of preparing the fat for analysis, the method of simply melting the butter, allowing to subside for a short time, and then filtering, seems to leave nothing to be desired. That the fat *gains* in weight when kept melted for a length of time at 100° C, or when heated above that temperature, is, I think, indisputable. A weighed quantity of fat was placed in a small basin, in the water oven, with the following result :—

After 1 hour with frequent stirring, the whole weighed ...	30·1840	grams
,, half an hour longer	30·1832	,,
,, 2 hours ,, ...	30·1864	,,
,, 1 hour at 110° C	30·1984	,,
,, 1 ,, rising to 116° C	30·2036	,,

In determining the water in the original butter, a constant weight is possible to be obtained if a moderate quantity of the sample is placed in a very flat platinum basin, on an *open* water bath, and weighed at short intervals. When the basin and contents were kept in a *close* oven, it was found very difficult to obtain a constant weight. It has since occurred to me that it would be of great advantage to dry the fatty acids obtained in the analysis, on the *open* water bath also.

The trouble and difficulty experienced in weighing out approximately five grams of the butter fat, more or less, for saponification, may be reduced to a minimum, by the following simple expedient. The melted fat is run into a small stoppered Schuster's burette, and the tubulation having been carefully cleaned from adhering fat, the stopper is replaced, and the weight of the whole ascertained and noted. An experiment is first made in order to find approximately the number of drops of fat, which must be transferred from the particular burette used by the operator, into a tared vessel, in order to make up five grams, and this number is also noted. With the burette used in these experiments it was found that 280[*] drops of butter-fat were required for five grains by weight. In practice it is only necessary to weigh the burette and contents (while fluid), loosen the stopper, and drop the required number of drops into the flask in which the fat is to be saponified. A drop or two may then be added in excess of this number in order to have the amount taken slightly *over* five grams, and the burette and contents are again weighed, to ascertain the *exact* weight of fat used. There are several advantages attached to this method of procedure. The fat remains longer fluid than in an open beaker. The wished for amount can be quickly obtained, and with ordinary care the neck of the saponifying flask is not soiled, and the fat has no tendency to run down the outside of the burette—an annoyance only too common when beakers, &c., are used—and even when a drop of fat does get outside the narrow orifice of the burette it very soon solidifies and remains stationary.

As regards the treatment and drying of the fatty acids, I have found the following very convenient :—After washing in the manner recommended by Jones, the cake of fatty acids is broken into small pieces. This is easily accomplished by a few taps on the flask, and there is then no difficulty in transferring the pieces to the filter. One or two judicious rinsings with cold water will then remove nearly every particle of fat from the flask, which is fixed in an inverted position over the filter, and the whole allowed to stand overnight. Next morning the flask is found to be quite dry, and a small quantity of ether will easily remove the traces of fat adhering to it. The fatty acids on the filter will be found to be pretty well air-dried, and can be readily removed to a tared flask, having a tolerably wide mouth. The rinsings of ether from the saponifying flask are then poured over the paper filter, and fresh ether poured over it till, on drying, no trace of fat can be seen. If the fatty acids have been carefully and completely removed from the paper, previous to washing, a comparatively small quantity of ether will suffice for that purpose. The flask can then be attached to a condenser, and the ether nearly all recovered by distillation on a water bath, and a few drops of absolute alcohol having been added to the flask containing the fat, the latter is further dried till constant in weight. As already stated, I think it would be more advantageous to dry the fat by placing the flask on an open water bath. The use of a flask such as I have mentioned, having a short wide neck, and with the weight marked on with a diamond, is, I think, preferable to that of basins or flat dishes. The ether used can nearly all be quickly recovered, and although, from a pecuniary point of view, this may be no great object, yet it avoids the risk of ether vapours floating about, and is a much more convenient method of getting rid of that agent. The fat does not rise up the sides of a flask, as it always does when flat dishes are employed, and the risk of a slight loss from this cause is avoided.

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[*] The approximate number of drops will, of course, depend on the temperature of the fat at the time of weighing.

In order to test the process, a sample of fresh butter was procured from a farm near Greenock. This farm, it may be stated, is somewhat celebrated for the quality of the butter made there. On examination this sample gave the following results.

The sp. gr. of the dried and filtered fat was found to be 912·94 at 100° F. Analysis gave :—

	Average.
Soluble Fatty Acids	4·74 per cent.
Insoluble „	89·37 „
Total „	94·11 per cent.

A sample of beef fat was also obtained, the fat from which, when dried and filtered, had a sp. gr. of 902·1 at 100° F. Four different mixtures of beef and butter fats were made up in the following proportions :—

	No. 1	2	3	4
Butter Fat	52·38	24·69	96·94	99·00
Beef Fat	47·62	75·31	3·06	1·00

Analysis of these mixtures gave the following results :—

		No. 1	2	3	4
Soluble Acids	Found	2·39	·95	4·50	4·67
	Calculated	2·48	1·17	4·59	4·69
Insoluble Acids found		93·37	94·94	90·76	89·64

A sample of butter sent to me for analysis, and which was afterwards admitted to be adulterated, gave the undernoted results :—

The sp. gr. of the dried fat was 906·1 at 100° F.

Soluble Acids (as butyric	2·20 2·17	2·18 per cent.
Insoluble „	91·89 92·18	92·03 „
		94·21 per cent.

Taking a standard of 5 per cent. soluble acids, and calculating to the origina butter, gives :—

Butter Fat	38·32 per cent.
Foreign Fat	48·76 „

The above results corroborate what, I think, has already been pretty clearly established, viz., that a careful determination of the soluble "fatty acids" affords a very correct basis for judging of the amount of foreign fat present in any sample of adulterated butter; the addition of even 1 per cent. of beef fat showing an appreciable difference in their amount, and that, with ordinary care, the present method is capable of yielding very concordant results.

My best thanks are due to my friend Mr. Gossman, who kindly undertook the greater part of the work connected with these experiments.

In the discussion on the above two papers on Butter Analysis,

Dr. Dupré said that with regard to Mr. Jones' paper, it was unfortunate that he had published two analyses of some of the butters mentioned. In his first paper he found all his insoluble fatty acids very high. It was suggested by some of the members that he had not washed the fatty acids sufficiently, and therefore had left some of the soluble fatty acids in the insoluble. Mr. Jones, with great moral courage, came forward at the next meeting and said he had not believed it had been the case, but he had made some experiments and found it correct, and the difference in the results (which Dr. Dupré specified,) of course threw the whole of the table out and made it useless. The only thing useful was the sp. gr., which was not likely to have been affected, and as far as they went they corresponded very much with some observations of his own. He had found that some butters did not vary much in two years and a half, while others changed very rapidly. The changes which butter undergoes depended greatly upon the character of the original butter, and it was evidently impossible to say at any time what a butter might be a year hence. With regard to Dr. Milne's paper he could not see the use of once putting the fatty acids in a flask and then taking them out, but having once put them in never take them out, and then there was no chance of losing any drop, or of any other difficulties. He held, and held very strongly, every butter analyses to be worthless that gave the fat as much above 98 per cent., that is the fatty acids plus glycerine residue. Taking the average of the ten analyses given in his (Dr. Dupré's) paper on butter, they came to 97·99 per cent. of fat.—taking the equivalent of the insoluble fatty acids at 275, and the soluble fatty acids as butyric acid at 88. Taking the four butters Mr. Jones had re-analysed, the mean was 98·05, and taking the four acids according to his first paper—admittedly incorrect—the fat came to 98·75. In Dr. Milne's paper the fat comes to 99·28. Dr. Dupré had no hesitation in saying that no analysis with a high percentage of insoluble fatty acids should be accepted, unless it was accompanied by the statement of the percentage of soluble fatty acids.

Mr. Hehner pointed out that the fact that fat increased in weight when kept melted at 100°, was already known. He further remarked, that in most of Mr. Jones' analyses the difference between the insoluble acids on the first and second analysis was small. He found on comparison, that in the soluble acids three had risen and six had fallen—that was assuming the analyses to be correct. If the soluble fatty acids had fallen, then there was very great risk of confounding a genuine butter with an adulterated one. Looking at the insoluble fatty acids three had risen, and two of those very inconsiderably, quite within the limits of error. Whilst it was possible that an adulterated butter might pass as genuine, he thought it was important that they should not condemn a genuine butter, but much rather let a bad one pass. In some cases the butters had changed considerably, in nearly all cases the fatty acids had gone in a right direction, and there was really no chance of confounding a genuine butter with an adulterated one. He thought Mr. Jones' figures were calculated to lead analysts into confusion.

The President having thanked the authors of the papers stated that he agreed with most of the remarks made by Dr. Dupré and Mr. Hehner upon them.

ON CONDENSED MILK.

By Otto Hehner, F.C.S.

Read before the Society of Public Analysts, on 19th February, 1879.

Our information as to the composition of the article known as condensed milk is somewhat contradictory. Thus Hassall gives four closely agreeing analyses, of which the following is the average:—

Water...	25·68
Casein	16·85
Milk sugar	15·35
Cane sugar	28·98
Fat	10·27
Mineral matter	2 80
	99·93

In consonance with these figures are those of Church. Wanklyn, on the contrary, states the contents as under:—

Water...	20·5
Fat	10·4
Casein	11·0
Ash	2·0
Cane and milk sugar...	56·1
	100·0

From the former of these analyses, assuming that the original milk contained 9·3 per cent. of solids not fat, I calculate that 3.76 parts of milk have been condensed into one part, and that the original milk contained 2·7 per cent of fat, and 0.74 of ash.

Wanklyn does not give the milk sugar separately, but calculating this, from the average composition of milk, to be 12·6, a figure which certainly cannot be far wrong, we obtain as milk solids not fat, 25·6 per cent, or a condensation of 2·75:1, the original milk containing 3·8 per cent. of fat, and 0·72 per cent. of ash.

Condensed milk being now very largely consumed, not only as an addition to coffee, tea, etc., but principally as exclusive food for infants, it seemed to me a matter of some importance to ascertain which of these conflicting analyses was correct, and the exact proportion of condensation of the various brands of condensed milk now in the market.

I purchased at different shops what I suppose are average samples of condensed milk. The prices paid varied from 5d. to 7d. per one pound tin.

The analysis was conducted somewhat differently from the method usually employed, because it was found to be quite impossible to completely extract the fat from the total solids by means of ether or benzoline, the large amount of cane sugar effectually protecting the fat. About 20 grms. were diluted with water so as to make 250 c.c., in 10 c.c. of this milk the total solids and the mineral matter were determined as customary; for casein and fat twice 25 c.c. were precipitated with a drop or two of acetic acid, and the coagulated casein, containing all the fat, collected on a weighed filter. In the one portion the casein and fat were weighed, from the other the fat was extracted by means of alcohol and ether, and the casein thus obtained. The milk sugar was determined gravimetrically by means of copper solution, and I adopted as basis of calculation the figures quite recently worked out by Rodewald and Tollens (Berl. Ber. XI., p. 2076), who, as the result of a most careful investigation, came to the conclusion that although the time of heating, the dilution of the solutions, and the proportion of excess of Fehling's solution employed, are all of some influence upon the proportion of cupric oxyde reduced, yet in any case but a small error could be committed by fixing the reducing power of one molecule of milk sugar at 7·47 eq. of copper.

The cane sugar was generally deduced by difference, but in a few cases I determined it directly, and obtained as concordant results as could well be expected.

I.—ANGLO SWISS CONDENSED MILK, PREPARED IN SWITZERLAND.

	1.	2.
Water	24·94	22·05
Milk sugar	13·29	12·85
Cane sugar	41·24	43·97
Fat	8·90	10.20
Casein	9·68	8·99
Ash	1·95	1·94
	100·00	100·00
Milk solids not fat	24·92	23·78
Condensation	2·67:1	2·56
Fat in original milk	3·3	4·0

II.—ANGLO SWISS CONDENSED MILK, PREPARED IN ENGLAND.

	3.	4.
Water	25·63	24·99
Milk sugar	12.50	11.92
Cane sugar	41·21	40·23
Fat	6·13	10.88
Casein	12·65	10·02
Ash	1·88	1·96
	100·00	100·00
Milk solids not fat	27·03	23·90
Condensation	2·9	2·57
Fat in original milk	2·1	4·2

III.—NORWEGIAN CONDENSED MILK.

	5.	6.
Water	28·85	29·05
Milk sugar	14·14	12·70
Cane sugar	36·74	38.14
Fat	9·21	9·66
Casein	8·98	8·58
Ash	2·08	1·87
	100·00	100·00
Milk solids not fat	25·20	22·52
Condensation	2·71	2.49
Fat in original milk	3·4	3·9

From the tin containing sample 6 a quantity of gas escaped on opening, and soon large proportion of the contents of the tin ran over in active fermentation.

HELVETIA.

	7.	8.
Water	25·29	26·37
Milk sugar	13·01	13·21
Cane sugar	41·04	40·27
Fat	7·19	6·98
Casein	11·73	11·34
Ash	1·74	1·83
	100·00	100·00
Milk solids not fat	26·48	26·38
Condensation	2·85	2·80
Fat in original milk	2·5	2·5

GERBER & CO.'S CONDENSED MILK.

	9.	10.
Water	23·68	24·47
Milk sugar	12·93	12.23
Cane sugar	41·80	40·31
Fat	9·74	12·76
Casein	9·80	8·22
Ash	2·05	2·01
	100·00	100·00
Milk solids not fat	24·81	22·46
Condensation	2·6	2·41
Fat in original milk	3·7	5·3

"CREAM MILK," HOOKER'S PROCESS.

	11.	12.
Water	19·11	18·94
Milk Sugar	13·75	13·68
Cane Sugar	44·11	42·92
Fat	10·27	11·77
Casein	10·66	10·47
Ash	2·10	2·20
	100·00	100·00
Milk solids not fat	26·51	26·37
Condensation	2·85	2·83
Fat, in original milk	3·6	4·2

Both these samples were very lumpy, and contained large crystals of sugar.

NESTLE'S SWISS MILK.

	13.
Water	15·30
Milk Sugar	13·62
Cane Sugar	50·08
Fat	5·85
Casein	9·98
Ash	2·17
	100·00
Milk Solids not fat	25·77
Condensation	2·76
Fat in Original Milk	3·2

The amount of milk solids not fat varied, therefore, from 22·46 to 27·03 per cent., corresponding to a condensation of from 2·41 to 2·9 into one part; the fat fluctuated between 6·13 and 12·76 per cent., or in the original milk from 2·1 to 5·3 per cent., the cane sugar from 36·74 to 50·08 per cent., and the mineral matter from 1·74 to 2·20, average 1·98 per cent.

Only in one case was there a deficiency of fat, that is to say the original milk must have been skimmed; in two others it came just to the lowest limit of genuine milk, namely 2·5 per cent.

The average amount of condensation was 2·69:1, or, in order to get a milk containing the same amount of milk solids not fat as did the original milk, to one part *by weight* of the condensed milk, 1·69 parts by weight of water must be added.

I found the specific gravity of three of the above milks to be 1·283, 1·272 and 1·287, average 1·281.

Hence, as the average amount of milk solids not fat was 25·09 per cent., to one part *by volume* of condensed milk 2·45 parts by volume of water must be added to obtain a liquid with 9·3 per cent. of milk solids not fat. The amount of total solids (average on the manufactured article 76·26 per cent.) contained in the milk would then, on account of the very large amount of cane sugar, be 28·3 per cent.

If, however, we dilute the milk to 12 per cent. of total solids, then the casein, its most important constituent, is reduced to less than one half the proper quantity.

Now contrast with this calculation the directions given by the manufacturers. I lay no stress upon the proportions of water recommended to be added to make a milk suitable for culinary purposes, but take the directions laid down for the preparation of milk intended for infant's food, because we have a good standard, namely the composition of human milk, whereby to measure these artificial liquids, "For infants add 7 to 10 parts of water" (Anglo-Swiss made abroad), "add 7 to 14 parts of water" (Anglo-Swiss made in England), "7 to 10 parts of water" (Helvetia), "from 15 to 18 parts of water" (Norwegian).

Assuming that human milk contains one third less casein than cow's milk does, we ought to add, instead of the 2·45 volumes as given above, to one spoonful of condensed milk 3·6 of water, instead of from 7 to 18! If the dilution is actually made in the proportion of 1 to 18, then the liquid is hardly better than a very dilute solution of cane sugar, containing no more than 0·68 per cent. of casein, instead of upwards of 3 per cent. as contained in human milk. This wash would be a starving diet indeed.

In human milk the proportion of nitrogenous matter to saccharine matter (1 fat=2·4 sugar in effect) is as 1:4·3, in condensed milk as 1:7·7

Condensed milk, however excellent and valuable it may be in many cases as a substitute for fresh milk when the latter cannot be had, appears hence to be totally and absolutely unfit to be used as a substitute for mother's milk.

I have no doubt that both Hassall's and Church's analyses are correct. If so, condensed milk must of late years have materially deteriorated and become much thinner than it was when those gentlemen made their analyses. 3¾ parts of milk were then condensed to one part; now only 2⅔ are evaporated to one, whilst the price has not, as far as I am aware, correspondingly decreased.

One tin of condensed milk, when *properly* diluted with water makes 2¾ pints of fluid milk. Reckoning the price of one pint of fresh milk at twopence halfpenny, 2¾ pints would cost less than sevenpence, the price often charged for the condensed milk. Hence there is no advantage, on the score of economy, on the side of condensed milk.

There is another most objectionable statement made in connection with some of these milks. Both on the Anglo-Swiss and on the brand bearing the name 'Nestle' it is directed "add less water (than 1:5) and it is equivalent to cream." As cream itself ought to contain no less than from 25 to 30 per cent. of fat, it is evident that no amount of dilution could make condensed milk, with its 6 to 12 per cent. of fat, "equivalent to cream." I am not sure whether this declaration, from the side of the manufacturers, does not bring the brands in question under the scope of the Sale of Food and Drugs Act.

Through the kindness of Dr. Stevenson, of Guy's Hospital, I was enabled to examine a sample of Italian condensed milk. This article formed a pasty mass of the consistency of butter. It contained water 37·1 per cent., milk sugar 18·89 per cent., and mineral salts 3·07 per cent., from which incomplete data the condensation may be approximately calculated as 4·6:1. It does not appear to contain any cane sugar, or, if any, but a very small quantity.

From one of the samples of which I have detailed the analysis, I isolated the fat. This furnished 88·1 per cent. of insoluble fatty acids, and hence was genuine butter-fat.

Mr. Wigner said that in determining the milk-sugar by copper solution after coagulating with acetic acid and inverting, it was quite improbable that the results would have been within 5 per cent. of the truth. The difficulties of this determination were so great that it was rather by fortunate work than by the accuracy of the processes available and used that the totals cast up as these did. As to the sample of Italian milk, he might say that condensed milk made without sugar, could be obtained in London in almost any quantity. With regard to the ash being the most correct estimation in the whole analysis, and therefore the one from which the proportion of concentration could be most fairly checked, he thought that in doing that Mr. Hehner must have omitted to notice the fact that the class of sugar used for the purpose always contained a large amount of ash itself, often considerably in excess of that found in the milk, so that it would be impossible to take the ash as a reliable basis, unless an allowance were made for the salts present in the sugar. Again, if he took it correctly, the figures 2·76 of concentration were drawn from the solids not fat. During the concentration of milk with sugar, even in a vacuum pan, the casein underwent very rapid decomposition, and the consequence was that the nitro genous matters in milk were very considerably altered during concentration. If a milk containing 3·5 casein were taken, and 40 parts were concentrated into 10 parts, instead of finding 14 parts casein, less than 10 would be found, as calculated from the ordinary nitrogen combustion. Mr. Wigner thought that whereas by Mr. Hehner's tables, 2·76 gallons, were being concentrated into one, the probability was that that 3·76 gallons were being concentrated into one. He would have much liked to have seen the analysis of the ash. The ash of sugar was largely alkaline carbonates. He did not know whether it had been mentioned, but the ash of milk contained almost 10 per cent. of its weight of chlorine.

After some remarks from Dr. Dupré and Mr. Hehner,

Dr. Muter said he agreed in condemning condensed milk as food, as he looked upon it as a most abominable thing for diet. If it were diluted sufficiently for an infant to digest it it was of no value as a food, and, if on the other hand, it were only diluted so that the casein should be as nutritive as in woman's milk, then an infant could not digest it. It was the cause of the death of many infants.

ON THE FALSIFICATIONS OF MILK.

By Charles A. Cameron, M.D., F.R.C.S.I., Professor of Chemisty, R.C.S.I.; Medical Officer of Health and Analyst for Dublin, &c.

Read before the Society of Public Analysts, February 19th, 1879.

A long list of alleged adulterants of milk is given in the books, some of which, there is every reason to believe, are purely apocryphal. In 1862 I was appointed public analyst for Dublin, and since that year the acts relating to adulteration have been put into operation in that city, and there have been convictions for selling adulterated milk and other articles every year since, and including, 1863. I was appointed analyst for other places in Ireland under the old act of 1860, repealed in 1872. I have therefore much experience as an analyst, especially at a time when there were no prosecutions of food adulterators in England, or, as a rule, in Ireland. During this latter mentioned period adulterators were not exposed to much danger of detection, and I believe their practices were conducted upon a very much larger scale than is the case at present, owing to the operations of the anti-adulteration Acts, even with all their imperfections of construction and administration. I mention these matters for the purpose of showing that I have had excellent opportunities of discovering all the adulterations of milk that have lately been practised in Ireland, and the following notes are a brief record of this experience:—

Adulteration with Water.—Water is, with but very rare exceptions, the only adulterant of milk used in Ireland. It is sometimes liberally employed. Many persons have been convicted in Dublin for having sold milk adulterated with from 50 to 120 per cent. of water—that is, to 100 parts of the pure milk, from 50 parts to 120 parts of water were added. In my certificates I state the amount of water added *to*, and not the amount of added water *in*, the milk. The most extreme case of adulteration with water which I have met with occurred some years ago at the workhouse, Mountmellick. The doctor noticed that an undue proportion of the children were suffering from rickets, and showing signs of under-nutrition. Acting on his suggestion, the guardians sent me three samples of the milk supplied by three different contractors: one I found to be a mixture of two parts of milk and one part of water, the second was composed of equal parts of milk and water, and the third consisted of two parts of water and one of milk—it contained only four parts of solid matter per 100 parts. One of the contractors who supplied this wretched stuff was a churchwarden of the parish!

The results of a large number of analyses of milk of undoubted purity have convinced me that the minimal standard of 9 per cent. of solid matters, minus fats, in milk is perfectly reliable. The adoption of this standard enables us to detect the addition of water to milk even when the total solids amount to more than 12 per cent. Some time ago I made an analysis of the mixed milk of a herd of Alderney cows owned by Colonel Forde, D.L., Seaforde, County of Down, and the following are the results obtained:

100 parts contained:—

Water	84·00
Fats	6·86
Cheesey matters and sugar	8·44
Ash	0·70
	100·00

The milk therefore contained:—

Solids *minus* fats	9·14
Fats	6·86
Total Solids	16·00

Here we have milk of exceedingly rich quality, and yet the solids, minus fats, did not exceed the proportion found in poor milk. The addition of even 6 per cent. of water to this rich milk could be detected. I may add, that this milk yielded 20 per cent. of cream, which I was informed was the usual proportion obtained in the dairy.

Adulteration with Sugar.—Only three cases of adulteration with sugar, and one with treacle, have come under my notice. In two of the former cases there were prosecutions by the Corporation of Dublin, but both unfortunately failed,—one owing to the death of the defendant before the case came on for trial; the other on account of a technical error made by the food inspector concerned in the case. In one of these cases the adulterants consisted of 90 per cent. of water and 1·5 per cent. of sugar; in the other 50 per cent. of water and 2½ per cent. of sugar.

Adulteration with Common Salt.—I cannot understand the object of adding salt to milk, but this substance is occasionally used for that purpose in Ireland. Last year the guardians of the North Dublin Union prosecuted a contractor who had supplied to them milk which I had certified was adulterated with 50 per cent. of water, and at least 0·5 per cent. of common salt.

Adulteration with Chalk.—It is a popular belief of great antiquity that chalk is a common adulterant of milk. On the other hand I am under the impression that public analysts doubt that such a sophistication ever existed. I have to record one, and the only, case that has come under my notice. A specimen of milk sent to me for examination by the guardians of Millstreet Union, county of Cork, was found to contain 1·11 per cent. of ash, of which one-half was insoluble in water, dissolved with effervescence in hydrochloric acid, and yielded lime equal to ½ per cent. of carbonate of calcium in the milk. The article was well watered, but the chalk had probably been added to rather stale milk to correct acidity, for the weather at the time was very hot.

Adulteration with Flour.—In Ireland this form of adulteration is excessively rare, as I have met with but one case of it. Last year I examined a specimen of milk for Mr. Lewis, the well-known perfume manufacturer, of Dublin, and found that it contained a very large amount of rice flour.

These are the only adulterants which I have found in milk. When the enormous number of samples which I have examined is considered, the cases of sophistication with articles other than water are extremely few and unimportant, numbering altogether only six, exclusive of salt, which is frequently added to milk. As these cases are authentic, and as similar forms of adulteration, except, perhaps, with salt and sugar, have not been noticed by the modern "public analysts," it is worth while placing them on record.

Milk deficient in Fats.—The practise of selling milk which has been deprived by skimming of a portion of its cream is much more general in England than in Ireland; but a very common practice in the latter country is to sell as whole milk that portion which is first drawn from the cow, and is termed "foreings," or fore milk. The fore milk is very poor in fat, which is the most valuable constituent of the article; whilst the portion of the milk last drawn ("strippings") is extremely rich in fats, and, in fact, is sometimes like cream. The average amount of fats in whole milk is about 3½ per cent.; whilst in fore milk it sometimes sinks so low as 0·5 per cent. So common is the practise of selling fore milk for whole milk that when I find a milk to have less than 2½ per cent. of fats, I certify that it has been deprived of a portion of its cream by skimming, or that it is fore milk, which practically is the same thing. On this form of certificate there have been many convictions obtained. In August, 1877, a dairy proprietor was fined £10 for having sold fore milk as whole milk, by a Dublin police magistrate. He confessed to the practice in court, and added that he sold the strippings as cream!

NOTES ON THE EFFECT OF LOW TEMPERATURES UPON MILK.

By Charles Estcourt.

This subject possesses a practical interest, inasmuch as it is not of singular occurrence to find a defence set up, founded upon such effect. The usual theory has been that cold causes all the watery portion of the milk to separate out and rise to the surface, all the solids of milk being left at the bottom, if the milk be exposed for a sufficiently long period.

Of course the whole theory pre-supposes no agitation of the milk by carriage, or stirring up in process of sale.

Assuming these practically impossible conditions, I obtained the following results in experiments with two milks. One milk was exposed to so low a temperature in a cylindrical vessel, about 2½ deep by 3 diameter, that the top, the sides, and a portion of the bottom joining the sides, were solidified to the extent of about one inch in thickness, leaving a portion liquid, which occupied part of the middle and bottom of the vessel :—

	Milk at ordinary temperature.	Solid from top.	Solid from sides half way down.	Fluid from middle and bottom.
			Per centages.	
Total solids	12·06	15·00	7·0	18·9
Solids not fat	10 04	6·50	5·8	18·3
Fat	2·02	8·50	1·2	0·6

Another milk (which had been watered) was exposed to a temperature of about 38° F with the result that no portion of it solidified in about 12 hours.

	Milk at ordinary temperature.	Liquid from top.	Liquid from middle.	Liquid from bottom.
			Per centages.	
Total solids	11·56	14·00	10·20	9·64
Solids not fat	8·83	8·74	8·74	9·03
Fat	2·73	5·26	1·46	0·61

In the case with which I was concerned, the Inspector, being the first morning purchaser, was served with the top portion of the milk, and it was urged in defence that this sample *appeared* by analysis to have been fraudulently watered, when in fact the effect was produced by the low temperature to which the milk had been exposed.

The results of my experiments, however, disposed of this theory, for I think I may safely say no analyst would suspect watering in a milk represented by "top" in either sample.

ON THE ESTIMATION OF ZINC IN SPRING WATERS.

By E. Hylius.*

When zinc must be estimated in potable waters, several litres should be evaporated in order to get weighable quantities of zinc. To save the trouble of evaporating the author uses the following method, with great success, in the absence of iron :—

2·6 grams of potassium ferrocyanide are dissolved in water, and then made up to 100 c.c. ; 3·536 of zinc sulphate are dissolved in water, and made up to one litre. 1 c.c. of this solution, therefore, contains ·01 of zinc oxide. Two glass cylinders, of about an inch and a half diameter, are filled, one with 200c.c. of the filtered sample, the other with 200 c.c. of springwater *free from zinc*. To each of them eight drops of hydrochloric acid and 2 c.c. of the ferrocyanide solution are next added. The ferrocyanide produces at once a cloud in the water containing the zinc. Zinc solution is now carefully added to the other, until the same turbidity is obtained. As the reaction takes some time to manifest itself, it is best not to add too much zinc at once, but to wait five minutes after every little addition of zinc solution. After this preliminary experiment, another 200 c.c. of the *sample* are put into a glass cylinder, with eight drops of HCl and 2 c.c. ferrocyanide. Five other cylinders are now filled each with 200 c.c. pure spring water, eight drops of HCl, and 2 c.c. ferrocyanide, and to the first one of these is added the same quantity of zinc solution as used in the preliminary experiment, to the

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* Correspondenz-blatt des Vereines, Analytischer Chemiker, Jahrg. 2, No. 3.

Second ... ... ·1 c.c. more.
Third ... ... ·2 c.c. —
Fourth ... ... ·1 c.c. less.
Fifth ... ... ·2 c.c. —

After standing for half-an-hour in not too strong daylight, the different turbidities are compared with the use of the sample. It is now very easy to calculate the amount of zinc.

The following three are selected from seven blank experiments, made by the author, to show the accuracy of his process, which, however, is no longer reliable, when the quantity of zinc exceeds ·05 gram per litre.

Taken	...	·02 gram ZnO	Found	...	·022
"	...	·01 "	"	...	·012
"	...	·002 "	"	...	·002

The presence of minute quantities of zinc does not seem so injurious to health as is generally believed. The author analysed a sample of springwater from Tuttendorf, in Germany, and found it to contain ·007 gram of ZnO per litre (·49 grns. per gallon), and he was assured that this water had been drunk by the population for about a century.

NOTE ON THE FILTER WASHING OF THE FATTY ACIDS.

By J. Brierley.

The fatty acids may be washed without any fear of loss from running through or over the filter, by simply using a double filter in the following manner :—

Take two filter papers of different sizes, fold them separately, and place the small paper inside the large one, with its triple fold towards the single part of the large paper.

If the papers used be of the same size, the fat is very often carried over the edge by the capillary attraction between the folds of the paper.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

CANE SUGAR IN MILK.

To the Editor of "The Analyst."

Sir,—In reply to Dr. Stevenson, I have much pleasure in giving details of my analysis of the sugared milk referred to in my letter of December, 1878 (*Analyst*, January, 1879).

The milk, which had a sp. gr. of 10·30, was first analysed in the ordinary way by Wanklyn's method, when the somewhat contradictory results induced me to make a second analysis—the results of which were quite concordant with those of the first.

	1st.	2nd.
Fat	2·94	3·10
Solids not fat	9·42	9·37
Ash	·57	·58

In both these the fat and solids not fat were rather low, but not sufficiently so to lead me to condemn the milk, but the low ash induced me to investigate the matter further.

Noticing that the milk was unusually sweet, I at first suspected glycerine, but not being able to detect any, I then thought of cane sugar, and it at once occurred to me that I might be able to ascertain whether it was present by taking a measured quantity—inverting one half by $H_2 SO_4$, and titrating both with Fehling. This I did, and the result indicated 3·1 per cent. of cane sugar in the milk.

In another portion I determined the casein, and found 2·9 per cent. Then $9{\cdot}37-(2{\cdot}9+3{\cdot}1)=2{\cdot}8$, the amount of lactose indicated by difference. No doubt this method gives *too high* a proportion of cane sugar, and I never pretended to determine it "accurately" by this method alone. Had I relied upon this exclusively, I should have said the milk had been adulterated with more than 30 per cent. of sugared water instead of "at least 20" per cent. I still, however, assert that "the whey of a milk sophisticated with syrup may be easily tested for cane sugar" in the way specified, as the difference will always be much greater than in the case of a whey unadulterated with cane sugar. If Dr. Stevenson, or any one else, can point out a better mode of detecting this ingenious (and I think often practised) sophistication, no one will be better pleased than myself.

Yours, &c.,

57, Lemon Street, Truro, *February 8th*, 1879.

J. H. COLLINS.

ANALYSTS' REPORTS.

At the quarterly meeting of the Bristol Town Council, on Tuesday, Mr. Stoddart, City Analyst, presented his report, which stated that during the past quarter he had made sixty-one analyses of food, &c., and found that ten were more or less impure or unadulterated. Of the articles analysed, fifty-four were brought by the inspector and seven by the public themselves.

At the Marylebone Vestry, Dr. Whitmore reported that during the quarter ending January 31, he had analysed forty-five samples of food consisting of 16 samples of milk, 8 of mustard, 9 of butter, 6 of coffee, 3 of bread, 1 of whisky, and 2 of gin. All the samples of milk, with one exception, were genuine. Three samples of mustard were adulterated with starch to the extent of from 25 to 30 per cent. All the samples of butter were so far genuine as to be free from adulteration of any fat other than butter, but it is important to notice that in several samples the water, salt, and organic matter (not fat) amounted to 16 or 18 per cent. of the whole. The samples of coffee were all genuine, as were also the samples of bread. The samples of whisky and gin were somewhat below the standard of strength at which they are usually sold; in other respects they were free from adulteration.

LAW REPORTS.

Milk of Sulphur Cases.—Mr. J. W. Bentley, grocer, High-street, Guildford, appeared to an adjourned summons charging him with having sold on the 1st of January last two ounces of sulphur not of the nature, substance, and quality demanded by the purchaser. The case had been adjourned, as were several others of the same kind, for the attendance of the borough analyst. The Town Clerk again appeared for the prosecution, and Mr. George White for the defendant. Evidence as to the purchase of the article by P. S. Titley having already been given, Mr. Angell, public analyst for the Borough, stated that he received from Mr. Superintendent Law the sample of "milk of sulphur" marked No. 59. He analysed the same, and found it was not "milk of sulphur" but "sublimed sulphur," or "flour of sulphur," the elementary constituents of which were the same as in "milk of sulphur," but prepared in a different way, and intended for a different purpose. The "flour of sulphur" was a much cheaper article than "milk of sulphur," which was made from "sublimed sulphur," with other ingredients added. If purchased by the cask "sublimed sulphur" would run about 16s. 6d. per cwt., while precipitated or milk of sulphur would cost 38s., and even that would not be a pure article. There was no lime in the sample, and the article was not a medicinal preparation. Any grocer upon being asked for the medicinal preparation of sulphur should refer the intending purchaser to a druggist. He believed there was a law which prohibited grocers from selling drugs. Cross-examined—He regarded himself as the representative of the interests of the

"Food and Drugs Act" in that borough. He suggested that the grocers as well as the chemists of the town should be called upon and asked for the "milk of sulphur." He could not positively say that he had the man sent round for the articles. Mr. D. Haydon, a magistrate—Mr. Angell would only be doing his duty in directing such steps to be taken. Cross-examination continued—There was neither lime, sulphate of lime, nor gypsum in pure "milk of sulphur." He was not aware that the term "milk of sulphur" was eliminated from the "British Pharmacopœia" in the last edition of 1867, which he had referred to. He knew that in the Runcorn case there was 58 per cent. of sulphate of lime in the sample of "milk of sulphur." Re-examined—He was satisfied that "milk of sulphur" and "precipitated sulphur" were synonymous terms. Mr. White, in addressing the Court for the defence, said that from the beginning it had been all a mistake, though originated by Mr. Angell in his desire no doubt to gain a reputation in the Borough. In the work which that gentleman had himself referred to as an authority for the case, the term "milk of sulphur" was not used, and it was clear that he should have given instructions for the purchaser to ask for "precipitated sulphur," and not that which was demanded. The term "milk of sulphur" might have remained in use amongst the people, but it was not in the "Pharmacopœia," and he was informed that "precipitated sulphur" was quite a different article, which was doubtless the reason of the omission to which he had drawn attention. He held that Mr. Angell should have got the purchaser to ask either for "sublimed sulphur" or "precipitated sulphur," and then probably the mistake would not have occurred. As it was, Sergeant Titley asked for an article which the trade had ceased to manufacture, and the nearest kind to it in the shop was supplied. The Bench surely would not convict the defendant of an offence, when the purchaser had simply misled him, and had gone for the sulphur to a grocer, who only sold the common kind. It had been contended by Mr. Angell that "milk of sulphur" and "precipitated sulphur" were synonymous terms, but others held differently, and it was manifest that by using one term when another was meant, all the tradesmen in the town might be taken in. Henry Williams said he was an assistant to Mr. Bentley. He remembered Sergeant Titley asking to be served with some sulphur. He understood him to mean the "powdered sulphur," which was, he believed, purer than the ordinary sulphur. He supplied him with two ounces for a penny, and was then told it was wanted for analytical purposes. Cross-examined. He did say that the powdered sulphur was purer than "milk of sulphur," as that was more adulterated. He did not tell the purchaser they did not sell "milk of sulphur," as he did not know there was any difference. He thought that the purest kind would be sure to do. He did consider he was selling a purer article than that which was asked for. He had seen "milk of sulphur," but not at Mr. Bentley's shop. He did ask another young man in the shop about the "milk of sulphur" at the time, and he said it was the same as what they had got. Mr. Sells, a magistrate: Then one was as ignorant as the other. There is as much difference between the two as between "Malaga" raisins and "Valentia" raisins. It seemed that in the matter of selling drugs they were going back 100 years. The defendant being asked from the Bench if he knew the difference between the two sulphurs, replied in the negative. There being no further evidence, the Mayor said they would reserve their decision until they had heard the other cases.

Mr. Frederick Wheeler, was also summoned for a similar offence. The Town Clerk observed that the distinction in this case from the others heard was that the defendant was a chemist and might reasonably be expected to know more about sulphur and other drugs, than the grocers, and he had further charged 2½d. for a precisely similar article to that which Mr. Bently charged only one penny for. Police Sergeant Titley said that he went to the defendant's shop on the 1st January, and asked for two ounces of "milk of sulphur," which defendant himself supplied and charged 2½d. for, and which he paid him. He told the defendant the article was wanted for the purpose of being analysed by the Borough Analyst, and that he could retain a portion of it if he liked, which he declined doing. Witness thereupon gave the packet to Mr. Superintendent Law. Mr. Angell stated that he received the sample No. 60 from Mr. Law, and upon analysing it, he found, as entered in his book (produced), that the sample consisted of "sublimed" or "flour of sulphur," which was an article of inferior value to "milk of sulphur," and of different preparation. By the Defendant: The article bought was pure "sublimed" sulphur. It was a different preparation to precipitated sulphur. The defendant said he gave the purchaser what he considered a pure "milk of sulphur." By Mr. Sells: I keep "milk of sulphur," and had some in my shop at the time. The ex-Mayor: Then why did you not supply it, as it was asked for? The Defendant: Because I should then have been prosecuted, according to Mr. Angell, for selling sulphur which contained lime, which the analyst states to be illegal. Mr. Sells: Then knowing the difference between "milk of sulphur" and "flour of sulphur," you purposely supplied the inferior article when asked for the other. Mr. Angell, in answer to Mr. Sells, said he did not find any arsenic in the sulphur which he analysed. He was certainly surprised at the mistake which had been made in serving the wrong articles, but he did not ask any questions as to how they had been made.

Mr E. Waller Martin, chemist, High Street, was summoned for the like offence. The Town Clerk said the distinction in this case from the others was, that the article sold was "Milk of sulphur," but contained 7·8 per cent. of sulphate of lime. Sergeant Titley stated that he visited the defendant's shop on the 2nd of January, and asked to be supplied with two ounces of "milk of sulphur," and was served by a shopman, who charged 3d. for the article, which he paid. He told him that the sulphur was bought to be analysed, and that he could keep a portion if he thought proper; he declined the offer, and witness handed the packet to Mr. Superintendent Law. Mr. Angell stated that upon analysing the sample No. 62 he found it to contain 7·8 per cent. of sulphate of lime, and the rest sulphur. "Milk of sulphur" certainly ought not to contain any lime. He repeated that "Milk of sulphur" and "precipitated sulphur" were synonymous terms. By the defendant: His authorities for saying they were the same thing were "Dr. Attfield's Manual of Chemistry" and works by Dr. Prior, Dr. Muter, and Ure's "Dictionary of Arts." (The witness read extracts from the works of the authors named, and observed that he knew of no higher authority than that of Dr. Attfield, who was Professor of Chemistry to the Pharmaceutical Society of Great Britain). He did place the authorities he had quoted collectively before the Pharmacopœia of 1867. Mr. Sells said he had medical authorities dating back to 1745, showing lime to be recognised as a component part of "milk of sulphur." Mr. Angell observed that that was before the use of hydrochloric acid was known. Mr. Sells said it was so recognised down to a very recent period, and he asked Mr. Angell if he was not aware that it was a fact that the older medical men in the present day preferred the old preparation of sulphur with a small quantity of lime in it? Mr. Angell answered that he was not aware such was the fact. Mr. Sells said he was old-fashioned enough as a medical man, and he preferred the old preparation, and he read an extract from the writings of an eminent surgeon of Liverpool, who held the like view. Mr. Angell in answer to Mr. Sells, said there was nothing to prevent the preparation being made in that way still; and that any person supplying "precipitated sulphur" when asked for "milk of sulphur" would not be substituting an inferior article, but in supplying "sublimed sulphur" they would be giving an inferior article to "milk of sulphur." Mr. D. Haydon asked what standard the chemists had to go by? Mr. Angell replied, the latest edition of the "Pharmacopœia." Mr. Haydon: Then must the magistrates regard the article as obsolete, or go back to a previous edition? Mr. Angell said the terms were bracketted now. Mr. Martin: Not in the addition we have here. Mr. Angell said he would admit that, but it was so in other works, the term "milk of sulphur" having no meaning, there being no milk in it, had been properly left out of the 1867 edition of the "Pharmacopœia." By Mr. Sells: With 7·8 of lime only in the article, there was no danger in it, but cases might occur, and indeed had occurred, where the proportion of lime had been from 70 to 80 per cent., which was a dangerous proportion. Mr. Martin said his case was simply that he as a chemist was bound to go by the "Pharmacopœia" of 1867, and he relied upon the decision in the Runcorn case, which was precisely similar to his own. He produced a report of the decision given in that case by the justices in Quarter Sessions, held at Knutsford in April 1877, Sir Hardinge Gifford, M.P., the Solicitor-general being one of the magistrates present, when the conviction of a chemist for selling milk of sulphur was quashed, it being held that in selling the article he had committed no offence within the meaning of the Act. He maintained that it was pure "milk of sulphur" that the witness Titley was supplied with, and that he had committed no offence within the meaning of the Act. The Bench then retired, and after a short deliberation, the Mayor announced that they had given the cases serious consideration, and as a result they found that in Mr. Martin's case the article was sold as was demanded by the purchaser, and the charge would therefore be dismissed; in the case against Mr. Bentley, the Bench considered he had acted wrongly, but he had charged a fair price for the article sold, and believing that a mistake only had been committed, they felt that justice would be met in the nominal fine of a farthing; in the case of Mr. Wheeler, it was admitted that quite a different article had been knowingly supplied by the defendant to what was demanded, and a fine of 20s. and costs would be inflicted.

ADULTERATION OF MILK.—At the Alton Petty Sessions, Edward Faithful, milkman, in the employ of Mr. W. G. Gunner, was charged with selling milk which had been adulterated with water. The charge was denied. The case was heard at the previous bench, but the magistrates, at the request of Mr. Gunner, postponed their decision till the milk had been analysed at the laboratory at Somerset House, defendant being dissatisfied with the county analyst's report, which was as follows:—

"I am of opinion that the sample of milk contained the parts as under, or the percentages of foreign ingredients as under:—Butter fat, 2·94 per cent.; solids not fat, 8·30; genuine milk, 89 parts; added water, 11 parts. Taking the lowest quality of genuine milk as a basis for calculation, there are at least 11 per centages of added water in this sample. If the original milk was of fair average quality much more must have been added. No change had taken place in the sample. Mr. Arthur Angell, the analyst, was examined as a witness, his evidence being to the following effect:—Water was a large component part of milk, but he was perfectly confident he could detect any excess, though there was no natural distinction between added water and that which formed a component part of the milk. The amount of fatty matter in the solids make the difference between rich and poor milk. The quantity of water in genuine milk is subject to but slight variation. According to the standard which has been fixed by the Society of Public Analysts 9 per cent. is the lowest quantity of "solids not fat," found in genuine milk. He was not certain whether keeping milk would add to the proportion of water which it contained. Decomposition might alter the relative proportions of liquid and solid matter. He believed he analysed the milk shortly after he received it. The feeding of cows would materially affect their milk as regards the fat it contained, but as long as the animals were healthy the quantity of the dry solids contained in the milk would be practically constant. He did not take the specific gravity of the milk. He was not of opinion that the fact of cows eating frosted sweeds would increase the proportion of water. The defendant, Edward Faithful, deposed that he milked the cows on the 12th of December, and afterwards sold the milk in the town. He swore that he added no water to it. The milk was out of his sight for about three-quarters of an hour in the shed, with the door shut but not locked, and someone might therefore have put water into it without his knowledge. He did not think there was any water in the can when he put the milk in. The Somerset House analysis was as follows:—The sample of milk referred to in the annexed letter was duly received on the 9th instant. We hereby certify that we have analysed the same, and declare the result of our analysis to be as follows:—Solids not fat, 7·54 per cent; fat, 3·57; water, 88·89. After making the addition for natural loss arising from the decomposition of the milk through keeping, the amount of "solids not fat," is lower than is found in genuine milk of low quality. From a consideration of these results we are of opinion that the mik contains not less than five per cent. of added water." The magistrates imposed a penalty of £5, fine and costs. The money was paid.

ADULTERATED WHISKEY.—At the adjourned hearing, at Bridgewater County Petty Sessions, of the case referred to in our last number in which a publican was summoned for selling adulterated whiskey. a certificate was produced, obtained by the defendant's solicitor from the laboratory at Somerset-house, contradicting, on material points, one from the county analyst, produced at a former court by the police. It was alleged in the latter certificate that the sample was entirely composed of plain raw grain spirit, lowered by the addition of about 30 per cent. of water, and coloured with burnt sugar. The Somerset house certificate stated that the sample of what was admitted to be the same spirit was a mixture of malt and raw grain spirit, of which Irish whiskey was generally constituted, and that it was free from impurities, The summons was dismissed.

NOTES OF THE MONTH.

According to the report of a recent trial at Guildford, the analyst is credited with stating that "he regarded himself as the representative of the interests of the Sale of Food and Drugs Act in that borough. He suggested that the grocers as well as the chemists of the town should be called upon and asked for milk of sulphur." Naturally our able opponent the *Chemist and Druggist* takes gleeful hold of this statement, and not only that organ but also the great apostle himself opens the vials of his wrath upon analysts generally. The former suggests that we should "be good enough to read the report of the Guildford case," and the latter, first quoting the regret expressed by our late President that our members were often wrongfully abused as public prosecutors, triumphantly points to the present instance as proving that the abuse is deserved. We would, however, beg to remind these authorities that exceptions are often necessary to prove the rule, and if one member of our Society so far forgets his position as to usurp the functions of the inspector, it does not follow that we are all equally oblivious to our proper stations. We regret much to have to disagree with any member of the Society, but in the present case we must hold that the analyst overstepped his province. He should remember the famous words of the French general, "above all, sir, *pas de zele*."

It would also, we submit, have been wiser for the analyst to have accompanied his certificate with a letter to the inspector, calling his attention to the decisions already given, *re* milk of sulphur, and then if the proceedings were taken, the blame (if any) would have been entirely removed from his door. The very object of giving reports in The Analyst of all the leading cases is to keep our members *au courant* with such decisions, so that when a case of the same kind occurs to them they can warn the inspectors by showing them the former decisions on the point.

What is "raw grain" whiskey? According to Mr. Stoddart he had a sample of so-called Irish whiskey, which was "simply raw grain spirit diluted with water and coloured by burnt sugar." According to Somerset House it was genuine Irish whiskey, "a spirit made from mixed malt and raw grain." Is ordinary German spirit of wine (made from any cheap farinaceous matter by conversion into glucose with a little malt and subsequent fermentation) then legally just the same as Irish whiskey, provided it is given the customary colour and flavour? We wish we could persuade the Government chemists to give us the process by which they discover a spirit made from a mixture of malt and raw grain, and to teach us where whiskey ends and raw grain spirit begins. Until this is done we cannot admit the analytical turpitude on Mr. Stoddart's part dwelt upon by the *Chemist and Druggist.*

When the Institute of Chemistry started it was not, we were assured, to interfere with the province of any existing body, but simply to devote itself to raising the standard of scientific chemists throughout the country. Having, even with all its intricate machinery of council and censors, failed to, as yet, do anything except collect a large amount of subscriptions (some of its members being busily engaged in running down fees, and unblushingly lending their names for advertising purposes without let or hindrance) it forthwith announces a "Conference" on "The Adulteration of Articles of Food," the notice of which says "*As Members only are admitted to take part in these Conferences, please bring this notice with you*"*!* All the learned societies in London we have ever heard of admit members of other learned societies as visitors, but this Institute still, as of yore, conducts its meetings on the secret principle. What can be the reason of this? Surely the Monthly meetings of the Society of Public Analysts are sufficient "conference" and conducted too by men who are daily engaged in food analysis. We shall watch with curiosity the results of this mountain in labour, but meantime it looks very like a case of an attempt to usurp the functions of our Society. It is possible that there are some organizers who would only be too thankful to see our Society dissolved, and our appointments transferred to their own pockets! Well we have done the work, and they are *only now beginning.*

There are female Pharmacists, and why not, says Mrs. Dr. Hoggan, female analysts? We are liberal enough to say that we would welcome to our ranks any lady who had the courage to brave several years' training in a laboratory, but when Mrs. Hoggan proceeds to talk of women microscopists setting up as "Housekeepers' Detectives" and going about from house to house examining food (of course for a consideration) we fancy the power of nonsense can no farther go. We have consulted our respected better-half, and she says, "Just let one of them come poking her nose into my house, and we will soon see."

As an addendum to Mr. Hehner's interesting paper on condensed milk, on a previous page, we may reprint the following paragraph from the *Grocer*—

"The Anglo-Swiss Condensed Milk Company have made a profit for the past year of £60,000, which, after writing off £16,000 for depreciation of buildings and utensils, and adding £16,000 to the reserve fund, will leave available for distribution among the shareholders £28,000, equal to 18 per cent."

We have received a large number of Abstracts from Public Analysts of their work under the Sale of Food Act during last year, but as we wish to publish the table in our next number, we should be glad if those Analysts who have not yet sent us their Abstracts, will kindly do so at once to enable us to make the table as complete as possible.

Sale of Food and Drugs Act Amendment.—The Bill introduced into the House of Commons by Mr. Anderson, with reference to the prejudice to purchaser question, and a standard for the sale of spirits, has been referred to a Select Committee.

Mr. T. A. Collinge has been appointed Public Analyst for Rochdale.

Mr. W. F. Lowe, F.C.S., has been appointed Public Analyst for the County of Flint

Mr. C. F. Saunders, M.D., M.R.C.S. has been appointed Public Analyst for the City of St. Albans.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
2281	C. W. Siemens	Regulating Electric Currents to Work Lamps	6d.
2350	C. D. Abel	Manufacture of Gas	8d.
2376	J. Hammond	Purification of Coal Gas by Concentrated Liquid Ammonia	6d.
2389	F. Wirth	Manufacture of Tar	8d.
2449	H. Unger	Manufacture of Soda	6d.
2516	W. Mead	Converting Spent Lime of Gas Works into Caustic Lime	4d.
2526	T. N. Kirkham and S. Chandler	Gas Purifiers or Scrubbers	2d.
2533	J. J. Shedlock	Manufacture of Gas	6d.
2571	H. G. Rober	Manufacture of Anhydrous Sulphuric Acid	6d.
2644	G. V. Alsing	Treatment of Sewage, &c	2d.
2658	T. Heskin	Manufacture of Magnesium	2d.
2662	H. Kenyon	Purifying Gas and Manufacturing Ammoniacal Salts	2d.
2695	G. Mackay	Purification of Liquids	4d.
2733	W. L. Wise	Treating Impure Water and Sewage	6d.
2795	C. McCanley	Apparatus for Burning Hydrocarbons	6d.
2937	J. Adamson and H. Booth	Treating Refuse and Sewage Waters	2d.
4301	H. Simons	Obtaining Sugar and other Compounds	10d.
4586	H. J. Haddon	Purifying Gas	2d.
4586	H. J. Haddon	Defecation and Refining of Saccharine Liquids	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Anti-Adulteration Review; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; American New Remedies; Correspondenz-Blatt; Kurze Chemische Mittheilungen, by Professor Franz Stolba; Medical Men and Manners of the 19th Century; Proceedings of the American Chemical Society. A new application of rapid oxidation by which Sulphides are utilized, by J. Holloway.

Mr. Perkins' note on Water Analysis will appear next month.

THE ANALYST.

APRIL, 1879.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held on the 19th March, at Burlington House, Piccadilly, the President, Dr. Muter, M.A., F.C.S., in the chair.

Mr. Hehner was appointed scrutineer to open the voting papers, and reported that Dr. F. A. H. La Rue, M.A., Professor of Chemistry and Histology at Laval University, of Quebec, Canada, had been elected as a member.

Mr. J. W. Tayler, assistant to Dr. Baker Edwards, of Montreal, Canada, and Mr. J. Nimmo, assistant to Mr. Bernard Dyer, were proposed as associates.

Dr. Dupré read a paper "On Violet Powder," and Dr. Bartlett, Mr. Hehner, Mr. Wigner and Dr. Muter joined in the discussion which ensued.

Mr. Hehner read a paper "On the Proposed German Adulteration Bill"

Dr. Muter also read a paper "On the Proposed United States Adulteration Bill."

Mr. Wigner read a paper "On the Work done by Public Analysts under the Sale of Food and Drugs' Act during 1878."

The next Meeting of the Society of Public Analysts will be held at Burlington House on Wednesday, April 30th, at eight o'clock.

PROFESSOR CHURCH AND THE ROYAL AGRICULTURAL COLLEGE.

THE Royal Agricultural College at Cirencester is to suffer another very severe loss. Professor Church, who for the last sixteen years has been at any rate as far as chemistry is concerned, the life and soul of the Institution, is practically forced into resigning, because perforce when after all these years of hard work, he has decided to marry, it does not suit the powers that be that he should reside outside the College walls any more than it is likely to suit the Professor's inclination to take his wife within them. A good deal of correspondence on the matter has passed between Professor Church and the Principal, and those outsiders who are interested, and naturally so in the success of the College as a College rather than as a private seminary, and were anxious that the services of the Professor who, more than most, has helped to make the College what it is should not be lost; but the Committee of Management, to whom the final appeal was made, have given their decision, which virtually amounts to the conclusion, that at Cirencester, as at any ordinary boys' school, it is necessary that the "masters" should have other duties besides those involved in satisfactorily occupying the chairs of professional science.

We think we have seldom seen a resolution so meagre and even devoid of acknowledgment of the services rendered during a long term of years, as the following one, which was passed by the Committee of Management on the 5th March, 1879, and we can scarcely wonder that after the passing of such a resolution, Professor Lloyd Tanner, who occupies the Chair of Mathematics, and Professor Fream, who occupies the Chair of Natural History, have both sent in their resignations. The College will thus lose all the professors who can claim any position in the scientific world, while the principle supposed to be embodied in the Resolution will not be carried out, for the "vet" is already non-resident. We cannot help expressing our regret at the severance of the connection of these gentlemen with an institution which *has* really been doing good work and its consequent decadence.

The following is the resolution referred to above:—

"The Committee of Management are of opinion that the discipline of the "Agricultural College cannot be satisfactorily maintained, except by the residence of "professors within the college walls in conformity with the original bye-law, No. 47. "Being fully sensible of the services rendered by Professor Church during his sixteen "years' residence in the college, they the more regret that they cannot accede to his "recent proposal of non-residence, a compliance with it involving such alterations as "would unduly disturb the *present organization of the College Staff.*"*

NOTE ON VIOLET POWDER.

By A. Dupré, Ph.D., F.R.S.

Read before the Society of Public Analysts, on 19th March, 1879.

The excitement produced last year in consequence of the numerous deaths occasioned by the use of arsenical violet powders, naturally drew attention to the question of violet powders in general, and several prosecutions for alleged adulteration of violet powder have since taken place. In one of these cases the vendor was convicted by the magistrate, but the conviction was quashed on appeal to the Salford Quarter Sessions. In a second case a conviction before a magistrate was also obtained, and no appeal, so far as I know, has yet been made.

Having been engaged for the Treasury in examining the various samples of violet powders instrumental in, or suspected of, producing arsenical poisoning, I have had my special attention directed to the subject of violet powder, and as some of my experiments not only throw light on the question as to the material best suited for such powder, but may aid analysts, and perhaps the magistrates, in deciding whether a given material is, or is not suited for the purpose proposed, I make no apology for laying the following simple facts before the Society:—

The powders experimented with consisted of the following materials:—Bermuda arrowroot, pure corn flour, wheat starch, potatoe starch with a little magnesia, corn flour with a little magnesia and orris root, Fuller's earth, and two powders consisting almost entirely of cystallized sulphate of calcium. Nothing need be said regarding the physical condition of the various starch powders, or of Fuller's earth, but a few words must be said regarding the last two powders mentioned.

Both these consisted almost entirely of crystallized sulphate of calcium, and both were decidedly rough to the touch. Under the microscope they were seen to consist of small crystals mostly with points as sharp as, nay sharper than, needles; some of these as much as $\frac{1}{400}$ of an inch long by about $\frac{1}{1000}$ broad. Altogether apparently as unsuitable material for dusting the delicate, broken skins of babies as could well be selected. Further acquaintance with some of the other physical characters of these powders does not diminish this first unfavourable impression. Violet powder is used chiefly for absorbing moisture and, other conditions being favourable, the more perfectly it does that the better it is.

In order to test the relative absorbing power of these powders let us spread small heaps about one-third of an inch broad by one-and-a-half inches long, on glass plates, microscopic slides for example, and place a drop of water on the same plate, just fairly in contact with one end of the powder heap. We shall find that the drop is almost instantaneously absorbed by the Fuller's earth, somewhat more slowly by the potatoe starch, still more slowly by the wheat, arrowroot and corn starches, and scarcely at all by the selenite powders. We may place drop after drop of water in contact with the Fuller's earth or the starch powders until the little heaps have become thoroughly moist by absorption from the one end, probably before the first, and certainly before the second, drop has become absorbed by the selenite. This simple experiment convincingly shows how little of true absorbing power these selenite powders possess. This conclusion is fully confirmed by the following experiments:—Small portions of the various powders were stirred up with cold water so as to form a very thin paste, which was left standing for one hour. At the end of that time the supernatant water was poured off and the remaining paste placed on blotting paper. After the lapse of a few minutes the moist powder was very gently pressed, with the fingers, between folds of dry blotting paper until no more moisture was taken up by the paper. Great care was taken to treat all the powders as nearly alike as possible. The amount of water contained in the powders thus treated was then estimated, and subtracting from this the water already present in the air dry powder, the amount of water taken up in the course of the above treatment was obtained. The results are given in Table II.; but, first, one other point has to be mentioned. The weight of equal bulks of these powders differ considerably, and hence it follows that the amounts of water absorbed per unit of weight, or per unit of volume, are not strictly proportional. The weight of any given volume of a powder differs also according to the way in which it has been put into the measure, but this variation seems fairy proportioned in all powders. In Table I. there are given the weights of 1000 grain measures of the various powders; firstly, when loosely put in; secondly, when shaken down (not compressed) as much as possible. As it may be a point of interest to some, I add the like particulars respecting white arsenic (sublimed, in the form of powder,) and terra alba.

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* The italics are our own, *Editors' Analyst.*

TABLE I.

Nature of powder.	Weight in grains of 1000 grain measures.	
	Put in loosely.	Shaken down.
Wheat Starch	538	826
Pure corn flour	494	836
Bermuda arrowroot	580	857
Fuller's earth	692	951
White arsenic	1665	2366
Terra alba	700	1157
,, ,,	758	1183
Violet powders, made with—		
Potatoe starch	596	811
Corn flour	489	762
,, ,, second sample	407	672
Potatoe starch ,, ,,	610	829
Selenite powder,	633	1132
,, ,, marked "steamer over globe"	629	1188

TABLE II.

Nature of powder.	Water absorbed by air dry powder, by	
	100 grains weight.	100 grains measure.
Wheat starch	72·0 grains	38·7 grains.
Pure corn flour	73·4 ,,	36·4 ,,
Bermuda arrowroot	81·3 ,,	47·1 ,,
Fuller's earth	82·1 ,,	56·8 ,,
Violet powder, made with—		
Potatoe starch	92·3 ,,	55·4 ,,
Corn flour	76·4 ,,	37·2 ,,
Selenite powder	35·7 ,,	25·0 ,,
,, ,, marked "steamer over globe"	39·9 ,,	25·1 ,,

A glance at Table II. will at once show how very inferior in absorbing capacity the two selenite powders are, and I cannot understand how it can be said "that they do not contain anything injurious to the skin, or unsuited for the purpose for which they are intended to be used as absorbent powders." To me it seems that they are very unsuited for use as absorbents, for which purpose nothing seems to be preferable to Fuller's earth or potatoe starch.

THE GERMAN ADULTERATION BILL.

By O. Hehner, F.C.S.

Read before the Society of Public Analysts, March 19th, 1879.

On another page of The Analyst the readers will find a translation of a draft of a Bill now under discussion before the German Parliament, to regulate the sale of food, articles of consumption, toys, wall papers, colours, cooking utensils, and paraffin oil. I do not propose to make any lengthy remarks on the Bill, since its clauses speak for themselves, and since other members of the Society are much more competent than I am myself to criticise the various provisions touched by it.

Most remarkable, to my mind, is the absolute want of any regulations in it concerning the analysis of the samples; whilst the purchase of samples, definition of adulteration, and punishment of offenders, are all spoken of at length, the word analyst does not even occur in the measure. The "Superior Court of Administration" will appoint the officers under the Act, but it is not even stipulated which shall be the "Court of Administration."

Far more interesting to us than the various clauses of the Bill itself are the voluminous papers accompanying the draft, which supply the reasons for and justify the several clauses. From a statistical table it appears that, in the year 1878, no less than 231,478 samples of food, drink, and other articles coming under the law, were analysed in the German Empire; of these 3,508 were adulterated (1·5 per cent.), 1,538 articles of food were decomposed and unfit for consumption, and 3,332 convictions of offenders were obtained. Of this enormous number of samples, milk stands first with 152,043 samples; beer, 17,628; sausages and meat, 21,380; flour and bread, 17,202; condiments, 1,168; wine, 842; sugar and confectionery, 508.

In Munich, 90,693 samples were analysed (87 convictions); Berlin, 75,867 (889 convictions); Darmstadt, 17,701 (190 convictions); Karlsruhe, 12,346 (160 convictions); Mannheim, 7,807; Heidelberg, 5,800; the remainder in 78 different towns and districts.

In explanation of the very large number of samples, it is to be stated that several towns, such as Berlin and Munich, have included in their returns all examinations made by market inspectors. The greater proportion of adulterated samples was, however, detected by accurate analytical examination.

A commission, including such well-known names as Drs. Hoffman, Fresenius, Knapp, and Varrentrapp, report at length on the various practices of adulteration. Among many modes of adulteration well known to all analysts, it will be learned with some interest that, instead of alum or sulphate of copper, sulphate of zinc has been used and detected in bread and flour, and that ground gypsum is regularly exported from Rotterdam into Germany, under the designation, "Artificial Flour," for adulterating flour. Quantities of gypsum up to 30 per cent. have actually been discovered in such adulterated flour, and sulphate of baryta up to 20 per cent. Maccaroni were found coloured with picric acid, brewing sugar contaminated with arsenic, milk mixed with soapsuds, beer with narcotin, coffee coloured with chromate of lead. But all these adulterations were observed only in single or very rare instances.

The laws and regulations concerning the sale of food of no less than 48 countries and cities are added to the report, English legislation being very fully treated of. The work done by the Society of Public Analysts is fully acknowledged, and the success of the "Sale of Food and Drugs Act," so far as that Act is a success, to a great extent attributed to the labours of the Society. The information afforded to Dr. Rottenburgh is worked into a general criticism of the "Sale of Food and Drugs Act," and has in several items been made use of in the drawing up of the Bill.

THE GERMAN GOVERNMENT AND ADULTERATION.

TRANSLATED BY O. HEHNER, F.C.S.

THE GERMAN GOVERNMENT has just laid before the German Parliament the following Bill, to regulate the sale of food, articles of consumption, &c.:—

§ 1. The sale of food and articles of consumption, as well as the trade in toys, paperhangings, colours, eating, drinking, and cooking utensils, and petroleum, is to be regulated by this Act.

§ 2. The officers of the Sanitary Police are empowered to enter any rooms in which the articles, coming under § 1, are kept for sale, during the usual business hours, or whilst the rooms are kept open for sale.

They are authorised to take, according to their choice, for the purpose of analysis, samples of the articles coming under § 1 and which are kept in the sale rooms, or which are sold in public places, upon market places, squares, streets, or which are hawked about. If requested, part of the sample must be left with the vendor, properly secured or sealed. For the sample the usual price is to be paid to the seller.

§ 3. The Sanitary Officers are empowered to make inspections of the premises of persons who have, according to §§ 10, 12, 13 of this Act, been sentenced to imprisonment, or of rooms in which articles specified in § 1 are kept for sale, or in which such articles intended for sale are stored.

This power of inspection begins with the date at which the sentence takes force, and ceases after three years, from the date on which the term of imprisonment ceases, or is remitted.

§ 4. Sanitary Officers, in the meaning of this Act, are the Medical Sanitary Officers, as well as those officers which are nominated as such by the Superior Court of Administration. The Central Authority of the Empire will decide which court has to act as Superior Court of Administration.

§ 5. By Imperial Decree, with assent of the Federal Council, regulations for the protection of health may be framed to prohibit

1. Certain modes of preparing, storing or packing articles of food or consumption intended for sale.

2. The trade and offering for sale of articles of food or consumption, of certain conditions, or under a name not corresponding to their real condition.

3. The sale and offering for sale for slaughter of animals, suffering from certain diseases, as well as the sale and offering for sale of the flesh of animals which were affected with certain diseases.

4. The use of certain substances and colours for the manufacture of wearing apparel, toys, paperhangings, eating, drinking, and cooking utensils, as well as the sale and offering for sale of articles manufactured contrary to this regulation.

5. The sale and offering for sale of petroleum of a certain nature.

§ 6. By Imperial Decree, with assent of the Federal Council, the manufacture, sale, or offering for sale, of articles intended for adulterating articles of food or consumption, may be prohibited or limited.

§ 7. The Imperial Decrees, issued under § 6, are to be laid before the next following session of Parliament. They are to be put out of force as soon as Parliament so requires it.

§ 8. Whoever acts contrary to the regulations of §§ 5, 6, is punishable with a fine up to 150 marks (1 m.=1s.), or with imprisonment.

§ 9. Whoever, contrary to regulations of §§ 2 to 4, refuses entry to the rooms, the taking of samples, or inspection, is punishable with a fine from 50 to 150 marks, or with imprisonment.

§ 10. Liable to imprisonment up to six months, and to a fine up to 1,500 marks, or to either of these, is—

1. Whoever, for the purpose of fraud in commerce, imitates articles of food or consumption, or adulterates the same by deteriorating them by the subtraction or addition of substances, or gives them the appearance of a better quality.

2. Whoever, knowingly sells articles of food or consumption, which are spoiled or imitated, or adulterated according to § 1, without giving notice of these circumstances, or offers them for sale under a name liable to lead to deception.

§ 11. If offences mentioned in § 10 have been committed by negligence, a fine up to 150 marks or imprisonment is to be inflicted.

§ 12. Liable to imprisonment, and to loss of civil rights, is—

1. Whoever prepares articles intended for the food of others in such a manner that their consumption is calculated to injure health, also, who knowingly sells, offers for sale, or otherwise brings into circulation as articles of food or consumption such articles which are injurious to health.

2. Whoever intentionally manufactures wearing apparel, toys, paperhangings, eating, drinking, and cooking utensils, or petroleum, so that the probable use of these articles proves injurious to health; also, who knowingly sells such articles, offers them for sale, or otherwise brings them into circulation.

The attempt is punishable—

If, through the action, grievous bodily injury, or the death of any person has been caused, penal servitude up to five years is to be inflicted.

§ 13. If, in the cases of § 12, the consumption or use of the articles was liable to destroy health, and if that circumstance was known to the vendor or manufacturer, penal servitude up to 10 years, or, if the death of any person was caused, penal servitude not under ten years, or for life, is to be adjudged.

Besides the punishment, supervision by the police may be ordered.

§ 14. If any of the actions indicated in section §§ 12, 13, has been committed through negligence, a fine up to 1,000 marks is to be imposed, or imprisonment up to six months, and if, by the action, the health of any person shall have been injured, imprisonment up to one year; but if the death of any person shall have been caused, imprisonment from one month to three years.

§ 15. In the cases of §§ 12 to 14, besides the punishment, the confiscation of the articles which were made, sold, offered for sale, or otherwise brought into circulation, is to be caused, no matter whether the articles belong to the defendant or not; in the cases of §§ 8, 10, and 11, the confiscation *may* be caused.

If in cases of §§ 12 to 14 the prosecution or punishment of any person is not practicable, confiscation of the articles alone may be caused.

§ 16. In the judgment it may be ordered that the sentence be made public, at the expense of the defendant.

On the motion of any defendant who has been found not guilty, the Court has to order the publication of the acquittal; the costs to be paid by the State, unless they are to be paid by the prosecutor.

In the order the mode of publication is to be stated.

§ 17. If, for the place where the offence was committed, a public institution for the examination of articles of food or consumption be in existence, the fines imposed by authority of this law, and as far as the State can dispose of them, go to the fund which provides the cost of maintaining that institution.

ON "PREPARED" COCOA.

By John Muter, Ph.D., F.C.S.

So much has been said and written on the qualities of cocoa as a beverage, that it would be useless to go over the well-trodden ground; suffice it simply to say, that it is one of the most grateful of our non-alcoholic drinks. The only objection which can and does exist to its use in a state of purity is the excessive proportion of fat which renders it too rich for most digestions, and gives unfortunately a colourable excuse for its admixture with starch. There are two classes of prepared cocoa:—(1) That in which the reduction of the fat is secured by adding starch and sugar; and, (2) That where the fat is partially removed and the remainder of the bean is served to the public unmixed. It is to show the fallacy of the former method that I pen these few lines.

In the first place it forms a question, what is the fair average composition of cocoa. Having had occasion to analyse a large number of samples, I am convinced that the following may be taken as representing a fair average of the constituent parts of ordinary cocoa, as at present found in the markets:—

No. 1.—Genuine Cocoa.

Fat	42·94	100·00
Sugar and gum	6·40	
Starch	19·03	
Cocoa red, &c.	3·69	
Cellulose	5·95	
Theobromine	·90	
Gluten	12·21	
Ash	2·90	
Moisture	5·98	

On looking at the composition of cocoa, as thus shown forth, the great fallacy of countenancing the addition of starch and sugar is at once apparent. The only possible excuse is the dilution of the fat, but then at the same time, the nutritious gluten and stimulating theobromine are equally reduced in value. On the other hand, given the removal of a portion of the fat, the other constituents are not only kept intact, but positively concentrated in a high degree. A glance at the following analyses of packet cocoas will prove the force of my remarks:—

	No. 2. Fat partially removed (Cocoa Essence).	No. 3. Mixed with starch and sugar (most of the latter).	No. 4. Also mixed with starch and sugar (most of the former).	
Fat	19·22	20·15	22·10	100·00
Sugar and gum	12·15	33·50	27·42	
Starch	22·37	27·21	29·22	
Cocoa red, &c.	4·60	1.60	1 80	
Cellulose	8.70	3·46	4·30	
Theobromine	1·20	·43	·50	
Gluten	18·30	6·45	7·36	
Ash	4·70	1·70	1·80	
Moisture	8·76	5·50	5·50	

For the sake of comparison I will put down the important constituents by themselves:—

	No. 1. Genuine.	No. 2. Fat removed.	No. 3. Mixture.	No. 4. Mixture.
Theobromine	0·90	1·20	·43	·50
Gluten	12·21	18·30	6·45	7·36

Thus we clearly see the nonsense talked by those who, for reasons best known to themselves, are found to palliate, and even support in writing, the "preparation" of cocoa by mixing it with starch and sugar.

In conclusion, I have only to urge those interested in the purity of food to expose and put down the mixture of cocoa with starch and sugar as useless, and founded altogether on a wrong basis. Unfortunately we, as public analysts, are prevented by a decision from reporting such mixtures as adulterated, but we none the less ought to teach the public by every means in our power to desert their use and stick entirely to the unmixed article, which, although dearer at first sight, is by far the cheaper in the end.

NOTE ON WATER ANALYSIS.

By Frank P. Perkins, Public Analyst for Exeter.

It is probable that what I now write may have come within the experience of every analyst.

In the determination of ammonia good results are obtained by the following method of manipulation:—Into a half litre retort place 25 c.c. of a solution of potassic permanganate, prepared according to the usual formula, add 100 c.c. of pure water, and distil until no reaction is obtained with Nessler's test; now add 250 c.c. of the water to be examined, and distil again until free from ammonia. The distillate contains albuminoid and free ammonia. The free ammonia alone is determined in another 250 c.c. of the water. By operating thus all traces of ammonia are expelled from the reagents and apparatus, and results as near perfection as the process will allow attained.

ON THE WORK DONE BY PUBLIC ANALYSTS UNDER THE SALE OF FOOD AND DRUGS' ACT DURING 1878.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 19th March, 1879.

From the information kindly furnished by most of our members, and by some gentlemen who are not members, I am again enabled to lay before the Society a very fair summary of the amount of work done during the past year, under the above Act, in nearly the whole of the districts in the country. The number of districts the returns I have received relate to, is 168, as against 127 districts for 1877.

The percentage of adulteration calculated upon the whole number of samples examined shows a slight improvement, and this I think will be best seen by putting it in tabular form. During the time of the *Lancet* commission the percentage of adulteration was:—

During 1872	65·0
" 1875-6	26·0
" 1877	18·1
" 1878	16·58

It is of course very satisfactory to find that, notwithstanding the obstruction caused in various parts of the country by the "prejudice to purchaser" question, the percentage of adulteration is still gradually decreasing.

As compared with 1877, the number of samples analysed shows a slight increase. In the two years ending December, 1876, the total number examined and reported to us was 15,989; in 1877, 14,785; and in 1878, 15,107.

The next most interesting point is probably to see in what way the per centage of adulteration has altered in different kinds of samples, and perhaps the best mode of showing this is to place side by side the results for the years 1877 and 1878, the figures in each case being the percentage of adulterated samples found, calculated on the total number of that particular sample purchased. We thus get the following results:—

	1877.	1878.
Milk	26·07	18·38
Butter	12·48	13·23
Groceries	13·00	12·89
Drugs, &c.	23·82	35·77
Wines, &c.	47·00	29·31
Bread and Flour	6·84	2·97
Sundries	21·63	14·98

In the returns for 1877 the worst place was occupied by wines and spirits, but this year drugs appear as the worst on the list. From some of the statistics it appears only too probable that this is not by any means the fault of the chemists and druggists, but that it arises from some inspectors having purchased samples of so-called drugs from grocers' shops, or at other places where drugs had no business to be sold; and as will be seen by the remarks in the table, the list includes a large number of samples of violet powder. It would be much more satisfactory if it were possible to state what proportion of these drugs were really pharmacopœia drugs, and how many were articles in reference to which a difference of opinion does exist, whether it is justifiable or not.

Next on the list this year comes wines and spirits, but with a very great reduction from the figures of last year. Milk also shows a reduction of more than seven per cent., and in fact I think for the first time since returns of this kind have been collected it falls below 20 per cent., or one-fifth of the samples purchased. Butter appears to be fractionally worse, but it seems not at all improbable that this slight increase may be due to the more universal adoption of efficient methods of carrying out the analysis. Bread and flour and groceries show a decrease, but it is even now a very serious thing that on a standard article of food like bread three per cent. of the samples examined should be found adulterated. The sundries also show a decrease, but, unfortunately, these in so many cases include water, which when condemned as unfit for drink, is included in the column for adulterated samples, that no special deducion can be drawn from this item.

Looking at the returns in another light, and taking the percentage of adulterated samples of each kind included in the total number of adulterated articles only—that is, there were 2,208 adulterated samples, the description of which has been particularly reported—I find that :—

Milk	formed ...	42·21	per cent.
Butter	" ...	3·35	"
Groceries...	" ...	18·07	"
Drugs	" ...	5·53	"
Wines and Spirits	" ...	23·33	"
Bread	" ...	1·54	"
Sundries	" ...	5·97	"
		100·00	

Here we have an increase in the case of milk from 36·6 to 42·23 per cent., of drugs from 4·2 to 5·52 per cent., and a decrease in the case of wine, bread, and sundries from 27·6, 3·1 and 7·7 per cent. respectively, to 23·35, 1·53 and 5·97 respectively.

We will next look at the percentage of adulterated samples in different districts. Southampton heads the list with 53·4 per cent. of the samples purchased. Yorkshire (East Riding) and Hull and Liverpool follow closely after, each of them having more than 40 per cent. Preston and North Derbyshire are between 40 and 30. Lancashire, Warwickshire, Londonderry and Yorkshire (West Riding) have more than 25 per cent.; Cheshire, Lewisham, Antrim, Belfast, Donegal, Tyrone, Surrey and St. Pancras more than 20 per cent. Guildford, Hants, Westminster, Durham, Staffordshire, Cork, and Sheffield more than 15 per cent.; while some of the remaining districts are perhaps sufficiently interesting as showing the greater purity prevalent there as to justifiy their being separately tabulated. Thus we find that Gloucester and Hereford show 1·4 per cent., Leeds 2·3 per cent., Dublin 2·6 per cent., Bedfordshire 5·9 per cent., Wandsworth, Lambeth, &c., 8·7 per cent., Devon 9·7 per cent., Hampstead 11·1 per cent., Cardigan, Carmarthen and Swansea 12·4 per cent., Somersetshire, Bristol, &c., 12·8 per cent., Hackney 14·2 per cent., and Greenwich 15·0 per cent. St. Martin's-in-the-Fields has only so recently been put into the efficient hands of Mr. Heaton that it is perhaps scarcely fair to notice that he has not yet come across any adulterated samples.

Referring now to another very important feature in these returns I find that in Barnsley, Chesterfield, Glossop, Denbighshire, Oban, Montgomeryshire, Lancaster, Cavan, Dumbarton, Paisley, Ashton-under-Lyne, Pontefract, Wakefield, King's Lynn, Deal, Faversham, Margate, Sandwich, Stratford-on-Avon, Warwick, Gloucester, Herefordshire, Huntingdon, Falkirk, Fifeshire, Brecon (city and county), Tenterden, West Suffolk, Maidenhead, Beverley, Monmouth, Norfolk, Reigate, Kilmarnock, Renfrewshire, and Sutherlandshire, or altogether 10 counties and 27 towns, with a population of close on 2,000,000, no samples whatever have been analysed, and this is perhaps one of the most striking proofs of the necessity of amending the Act, so as to render its working

	…s	20	1	5	—	6	—	—	—	—	—	7	—	—	—	43	1	
,,	Pontefract	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,,	Wakefield	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,,	Yorkshire (N.R.)	11	—	1	—	30	4	1	1	7	1	5	—	1	—	56	6	
W. GATEHOUSE	Bath	84	9	—	—	13	—	—	—	18	8	3	—	7	—	125	16	
GOODE	Derby (Borough)	10	—	—	—	—	—	—	—	—	—	—	—	—	—	10	—	Appointment made at latter end of year.
,,	,, (S.) (County)	3	1	—	—	9	—	1	—	15	6	6	—	—	—	34	7	"Prejudice" question stopped purchase of samples.
H. GRAMSHAW	Gravesend	—	—	—	—	—	—	—	—	—	—	—	—	38	38	38	38	Only waters were examined, and all were condemned.
M. HAMLET	King's Lynn	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
SHEA	Reading	27	2	1	—	13	1	—	3	—	4	1	1	—	1	55	4	
W. STOKES	Paddington	45	16	—	—	1	1	—	—	—	—	—	—	6	—	52	17	
SERGEANT	Bolton	27	9	2	1	2	1	4	1	—	—	7	—	5	2	47	14	
W. STODDART	Bridgewater	15	8	—	—	—	—	—	—	—	—	—	—	—	—	15	8	
,,	Bristol	232	52	8	—	6	3	—	—	1	—	3	—	3	1	253	56	
,,	Salisbury	—	—	5	1	—	—	—	—	3	—	3	—	—	—	11	1	
,,	Somersetshire	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1015	101	
SUTTON	Norfolk	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,,	Yarmouth	8	3	3	—	—	—	—	—	—	—	—	—	—	—	11	3	
STEVENSON	Bedfordshire	4	1	20	—	45	—	2	1	16	3	30	2	1	—	118	7	
,,	Reigate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,,	St. Leonard, Shoreditch	4	1	8	5	—	—	6	3	—	—	16	3	—	—	34	12	
,,	St. Pancras, Middlesex	98	27	25	—	33	5	12	3	8	3	20	—	—	—	196	38	
,,	Surrey	59	5	51	4	190	14	2	—	133	80	16	—	—	—	451	103	
TRIPE	Hackney	34	6	6	—	42	1	—	—	15	10	10	—	13	—	120	17	
W. THOMAS	Cardiff	58	6	6	—	41	1	12	1	15	7	9	—	4	—	145	15	
,,	Newport	27	14	5	—	16	—	—	—	22	9	4	—	—	—	74	23	
W. WALLACE	Ayr	—	—	—	—	—	—	—	—	4	—	—	—	—	—	4	—	
WALLACE, TATLOCK, and CLARK	Glasgow	3	1	1	—	—	—	6	4	4	—	—	—	2	—	16	5	The drugs were all violet powders.
	Johnstone	3	—	1	1	2	—	—	—	—	—	2	—	—	—	8	1	
,,	Kilmarnock	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,,	Lanark	2	—	—	—	..	—	—	—	—	—	—	—	—	—	2	—	
,,	Renfrewshire	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
,,	Rutherglen	2	1	2	1	—	—	—	—	—	—	—	—	—	—	4	2	
,,	Sutherlandshire	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
WHITMORE	St. Marylebone	56	11	18	1	80	10	6	3	7	1	7	—	1	—	175	26	
W. WIGNER	Greenwich and Deptford	20	4	6	2	43	4	10	—	17	3	2	—	4	—	102	13	
	Plumstead	31	14	15	4	44	—	8	—	16	2	2	—	6	—	122	20	
,,	Woolwich	13	7	8	2	27	2	10	—	12	2	4	—	9	—	83	13	
,,	Parsonstown	3	—	—	—	1	—	—	—	2	—	3	—	9	3	18	3	Sundries were all waters.
WOODS	TOTALS	5068	932	559	74	3095	399	341	122	1757	515	1142	34	881	132	15107	2505	

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compulsory. While in 23 more towns, with a population altogether of about 850,000, only 271 samples, or an average of less than 13 per town, have been examined, although these include such populous places as Edinburgh, Cambridge, Yarmouth, and at least one of the London Districts, Mile End Old Town.

There are also 13 counties, viz., Carlow, Kildare, Leitrim, Fermanagh, Westmeath, Queen's County, Wexford, Cornwall, East Riding of Yorkshire, South Derbyshire, Donegal, Londonderry and Tyrone, with a united population of about one and three-quarter millions, in which only 205 samples have been analysed, or an average of about 16 per county.

In Scotland hardly anything has been done, owing to the decision given there on the "prejudice" question. Only 96 samples were examined as against 350 in 1877.

In Ireland 3,495 were examined, of which 342 were adulterated, or 9·78 per cent.

This, of course, is largely due to Dr. Cameron's enormous number of 2,785 samples; 203 of these, or 7·28 per cent. being adulterated.

There were four cases of diseased milk reported, one from each of Mr. Heisch's districts, and two from one of my own. Mr. Heisch also examined some samples of starch, which can hardly be considered as a food, and Dr. Barclay reports having examined gas containing carbonic acid.

The prejudice question seems to have been raised in about 30 places, and in no less than 9 it has been upheld by the Magistrates. As this decision may have a very important bearing on the results previously referred to, it is as well to note that these places are Canterbury, Derby, Southampton, Glasgow, Cornwall, Sheffield, Cumberland, Lancashire, and York, and as the practical result, inspectors have ceased taking samples in Newcastle, Southampton, Derbyshire, Cambridge, Brighton, Yarmouth, Cumberland, Hull, Durham, Dumbarton, Maidstone, and in Scotland generally.

In West Suffolk the Magistrates are of opinion that the police have enough to do already, and therefore they have never collected any samples at all. Adulteration is reported to be on the increase at Southampton, which figures highest in the table, Glasgow, King's Lynn, Sheffield, Yarmouth, and Hull, at most of which places the Act is practically a dead letter.

In reference to spirits, if the adulteration is simply a dilution with water the Magistrates will not convict at Bristol, Londonderry, Hackney, or Stockton, while at Hull and Cork it has been decided that no prosecutions shall be undertaken until a standard has been fixed.

The Magistrates at Cardiff have given the unique decision that the exact price of the article purchased must be tendered by the inspector, and no change be required, and as another equally amusing illustration of Magistrates' wisdom, I may mention that Mr. Collins reports that in Cornwall, a case was dismissed because the certificate stated that the "sample of milk" was marked, and the Bench decided that it was impossible to mark a sample of milk, but only the bottle containing it!

In the discussion which ensued,

Dr. Bartlett said they might consider that for some time past the Act had been a dead letter where it had previously been an advantage, and adulteration was now more or less in the ascendant in consequence. He thought the returns showed the advantage that a better constituted Act would create, and also the necessity for making the Act compulsory.

Dr. Muter said that he thought the returns did not tell the truth about drugs; what some people deemed an adulterated drug, other people did not. There was nothing that a standard was so much wanted for as drugs, and if there was to be an amendment in the Act, he hoped there would be one as to drugs.

THE STANDARDIZING OF PERMANGANATE OF POTASH, BY MEANS OF PLUMBIC OXALATE.

By Professor F. Stolba.[*]

Instead of using oxalic acid the author prefers its lead salt, for the following reasons :—

1. It does not contain water, and can always be got pure.
2. It does not take up any moisture even after several days' exposure to the air.
3. Its high molecular weight (one part of it = ·427227 parts of oxalic acid), also gives it an advantage over oxalic acid, as good results may be obtained even by using a less delicate balance.

The process of standardizing is conducted in exactly the same manner as when oxalic acid is used. Dilute sulphuric acid is added, and the liquid heated; plumbic sulphate and free oxalic acid are formed. One gram of plumbic oxalate corresponds with

·379757 Iron.
·189878 Calcic Oxide.

The author gives the results of four experiments which agree exceedingly well, different quantities of plumbic oxalate being taken each time for the standardizing. The following process is used by the author to prepare pure plumbic oxalate:—Plumbic acetate is dissolved in water, acidified with acetic acid, the solution boiled with lead foil to throw down traces of copper or silver, then precipitated with oxalic acid in excess. This precipitate is washed by decantine with water till the washings are no longer acid, then dried at 120°c. and kept in a well-closed bottle.

THE ANALYSIS OF WINES.

By R. Keyser.[†]

The author calls the attention of analysts to the following somewhat unpleasant fact:—An analytical chemist of good repute analysed some time ago a sample of wine for a wholesale dealer by the usual process, viz., estimation of alcohol, extract, acids, and ash, also by its action on polarized light. The results of the analysis justified him in reporting: There is not the slightest doubt this wine is genuine from a chemical point of view. Now the wholesale dealer acknowledges his wine to be an *improved* one. In what the improvement consists he does not mention. But whether it consists in plastering, sugaring, colouring, or fortifying, his wine is adulterated.

It now appears that this ordinary process is insufficient. A more complete analysis and estimation of every constituent must be made to form an opinion. The author strongly recommends the complete analysis of the ash. The relative amounts of lime, magnesia, potash, soda, sulphuric acid, phosphoric acid, and silicic acid are more constant in wines of the same origin than has generally been believed.

The Colour Measurer.—Professor Koenig, of the University of Pensylvania, has designed a new instrument, which he calls a chromometer for determining the amount of metals in ores. He prepares borax beads, containing known quantities of the metal to be estimated, and notices of what thickness a glass of the complementary colour to the bead must be to make it appear colourless. The coloured (green or red) glass used, is of wedge shape, and is provided with a graduated rack movement, by means of which a reading is obtained, that, on referring to a special table, gives the amount of the metal present. By this process an estimation of manganese can be made in 15 minutes.

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[*] Correspondenz blatt des Vereines, Analytischer Chemiker, Jahrg. 2, No. 3.
[†] Kurze Chemische Hittheilungen von Prof. Fr. Stolba.

THE LONDON WATER SUPPLY.

Dr. Tidy's annual report on the quantity and quality of the London Water Supply is somewhat more than usually interesting this year, because of the discussion likely to take place in Parliament on the matter. Dr. Tidy adheres to his often expressed favourable opinion as to the general character and quantity of the supply, and he probably brings more figures of reliable analyses to prove his point than would be available from any other source. It is, of course, greatly to be regretted that the analyses made by Dr. Frankland are not published in such a form that they would admit of direct comparison with those of Dr. Tidy, and we think it is also to be regretted that both gentlemen appear for all practical purposes to ignore the use of the microscope. Surely there is nothing which can so readily throw light on any points, which may otherwise appear mysterious in water analysis, as a careful microscopical examination of the water itself and its sediment; more especially would this be the case, if in the analyses we are now referring to, Dr. Tidy had given us any statistics of the microscopical appearances, presented by the Thames and the East London waters. The analyses given enable a comparison to be readily made between the unfiltered and filtered Thames water, and the result appears satisfactory. The filtration has been fairly efficient, and the oxidisable organic matter has been fully one-fourth oxidised, notwithstanding a slight increase of chlorine pointing probably to the fact that concentration has taken place.

SHORT NOTICES OF BOOKS.

Our Domestic Poisons. *By Henry Carr, M. Inst. C.E.**—This little pamphlet collects within the space of fifty pages a vast number of instances of the poisonous effects of certain dyes and colours used in domestic fabrics. Special attention is, of course, given to arsenical wall papers, arsenical green muslins, and chromic green gloves. The *brochure* is forcibly and concisely written, and worthy of attention by both our Legislature and the general public. Mr. Carr is evidently in earnest, and we wish his efforts every success. It would be a most excellent matter to be taken up by some energetic M.P.

Medical Men and Manners. *By* 'Ατι θάσσευτος.†—The original edition of this amusing book was published in 1876, and the second is now before us. It has been extended to 180 most readable pages. Once take it up, and you are certain of a pleasant hour's entertainment, and not merely that, but also food for deep thought and regret that the noble profession of medicine should be made so often the cloak of incapacity and quackery. It should certainly be read by every medical man desirous of maintaining his professional dignity.

The Hygiene of the Skin. *By J. L. Milton.*‡—This shilling pamphlet is the work of the lecturer on skin diseases at St. John's Hospital. It is designed as offering in a popular form "a set of rules for preserving the skin in a high state of health, and assisting the restoration of it to a proper standard when the reader is under treatment for disease affecting this part of the frame." Even with this apology, however, we can scarcely see the necessity for such a work, seeing that any one under treatment would as a matter of course receive his instructions from the medical man who had the case in hand; besides, as a rule, we do not think popular works on medical subjects very desirable. As to its medical merits we are of course dumb; so we can only say that it appears to be well and concisely written, and gives much information as to the necessity of cleanliness, &c. We should think that it will prove popular.

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* London: W. Ridgway, Piccadilly. † London: Baillière, Tindall, and Cox, King William Street, Strand. ‡ London: Chatto and Windus, Piccadilly.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

CANE SUGAR IN MILK.

To the Editor of "The Analyst."

Sir,—Mr. Collins, in his reply to me, does not give those details of the analysis of his sugared milk which are requisite to enable every chemist to judge of the solidity of Mr. Collins's conclusions. Will he kindly state (1) the extent of dilution of the whey used for titration, (2) the amount of Fehling's solution employed, and its strength in copper, (3) the quantity of whey required for reduction of the Fehling's solution, both before and after inversion? I ask for this information because Mr. Collins appears to have got the amount of lactose by deducting the casein and cane sugar from the amount of solids not fat. Surely he must have obtained it also by direct titration. I confess that I know of no *accurate* method of estimating cane sugar in the presence of milk sugar. I intend to try the method of Tollens, as used by Mr. Hehner, and also the new and beautiful method of Dr. Pavy (Pr. Roy. Soc., Jan., 1879) for the estimation of glucose.

Yours, &c.,
THOS. STEVENSON.

CONDENSED MILK.

To the Editor of "The Analyst."

Sir,—I hope I am not asking too much in requesting you to allow me to reiterate a few remarks in reply to Mr. Wigner's criticism on my paper on "Condensed Milk." I thought I had clearly and conclusively answered the criticisms in question at the last meeting of the Society of Public Analysts, but as my reply is not reported in The Analyst, I am in justice entitled to explain.

In all cases the cane sugar was acknowledged to be deduced *by difference*, hence "the totals cast up as they do"; in a few cases the figure was checked by direct experiment and then fairly agreeing results were obtained.

I adhere to my calculation, namely, that 2·69 parts of fresh milk have been condensed into one, both the amount of total milk solids not fat, and the percentage of mineral matter proving the correctness of this figure. The sugar used *cannot* have contained much ash, otherwise the proportion of ash would have been much higher. The average of mineral matter was found to be 1·98. This, divided by the condensation, 2·69, gives 0·73 as the percentage of ash in the original milk, a very trifle higher than the average amount.

Had, further, really anything like a considerable decomposition or loss of casein taken place, and had a larger proportion of milk than 2·69:1 been evaporated, the amount of ash would of necessity be higher. Thus the single item ash does entirely disprove Mr. Wigner's statements.

Of course it is quite possible that during the evaporation some of the casein, and with it a proper proportion of other constituents, may have been mechanically lost, but this does not affect my analyses, which merely show what *is* in the condensed milk. One might as well argue that the milkmaid spilled the milk, hence really 3·6 instead of 2·6 parts of milk were originally used.

In no case did the ash of condensed milk effervesce with acids, and carbonates, derived from sugar, beyond the usual traces, were absent.

I should be happy to learn what better process for the determination of sugar than that used by me could be employed. Perhaps the polariscope, when there is in the milk, cane sugar, invert sugar, lactose and galactose, and possibly rotating nitrogenous matter?

London, *5th March*, 1879.

I am, Sir, Yours &c.,
OTTO HEHNER.

P.S.—Since writing the above I have carried out Mr. Wigner's suggestion, and have made a full analysis of the ash of condensed milk. The following are the results, together (for the purpose of comparison) with an analysis of ash of genuine milk, quoted by Wynter Blyth:—

	Condensed Milk.	W. Blyth, Genuine Milk.
CaO	22·63	22·97
MgO	2·34	3·31
Na_2O	7·22	11·58
K_2O	27·77	18·82
P_2O_5	25·30	27·03
SO^3	1·89	—
Cl	16·08	16·23
	103·23	99·94
Minus Oxygen for Chlorine...	3·62	
	99·61	

There was a very small quantity of carbonic acid (as $CaCO_3$) in the ash, but this I have not determined.

DUTIES OF PUBLIC ANALYSTS.

To the Editor of "The Analyst."

Sir,—Will you allow me sufficient space in your next issue for an insertion of the following remarks upon certain editorial comments which appeared in "Notes of the Month," for March, No. 36?

No public analyst, whatever his private opinions may be, can form an "exception to the rule," but must stand to the Sale of Food and Drugs' Act, and to his official duties in the same relation as do all his compeers: his duty is to *inspect* articles submitted for analysis, and to *detect* adulterations; he is at once *inspector* and *detective*, and is therefore the chief agent by means of which the interests of the Acts, which he ought to feel he represents, namely the detection and suppression of adulteration, are consummated.

The public analyst may represent the interests of the Acts, without himself being what is commonly called an interested party; if he fully carries out the duties of his office he will give to the people genuine articles of consumption, thus his duties and the interests of the Acts are identical, and in this sense the public analyst is a representative man, and certainly need not be oblivious, but rather think with pride of his position as such.

The legislature recognised and made special provisions to keep free from personal influences the disinterested representation of the interests of the Acts by the public analyst, by inserting the clause which prevents him from trading in articles of food, drink or drugs.

In another Note of the month it is pointed out that the analyst should have taken it upon himself to direct the actions of the inspector, as to the advisability of prosecuting. How could he do this without being the very personification of the interests of the Acts? In Note one the analyst is said to have usurped the functions of the inspector by making a statement whilst under cross-examination, in Note two he is taught how to usurp them by actual interference.

Why the editors or any member of the Society of Public Analysts need fear to boldly assert what is patent to all I cannot understand.

Yours &c.,

March 5th, 1879. ARTHUR ANGELL.

LAW REPORTS.

Adulterated Milk.—William Wharfe, farmer, was summoned at Bradford, for selling adulterated milk. Inspector Chambers stated that he purchased a pint of milk from the defendant and gave it to the public analyst, whose report stated that the milk was adulterated with 10 per cent. of water. The defendant said one of his cows was taken ill and gave short milk, and he put a little water to it to make the proper quantity. The Town Clerk remarked that the milk was not only adulterated, but from a cow which was ill. The Mayor said the case was a very bad one, and they had been considering whether they should not fine the defendant £10, but he would be let off with £5 and costs.

The "Prejudice" obstacle overcome.—At Westminster, Mr. Freeman, Kings Road, Chelsea, was summoned for selling adulterated milk. Mr. Young, inspector of the Parish of St Luke, stated that he purchased a quart of milk at the shop of the defendant, and told him he required it for the purpose of analysis. He divided it into *four* parts, one for himself to use, another to keep, one for the analyst, and one he gave to the defendant. The certificate of Dr. Barclay, showed that the milk contained at least 19 per cent. of added water. He (Mr. Young) had suffered no ill-effects from the milk he took in his tea, although he must have been "prejudiced," as it was not pure. The magistrate fined the defendant 20s., and 2s. costs.

Adulterating Beer with Salt.—Frank Evans, of the "Mug House," Worcester, was summoned for having sold ale adulterated with salt. Mr. Beauchamp defended. Constable Checketts said he bought two quarts of ale from defendant's wife, and handed it to Dr. Swete, the county analyst. Dr. Swete stated that the beer contained 66 grains of salt per gallon, and it was considered in such cases, that where the quantity was more than 50 grains it was excessive, and justified a prosecution. He had analysed the water of the well of the "Mug House," and it contained 6·1 grains of salt per gallon. Malt and hops would contain 8 grains of salt; so that there should only be 14·1 grains of salt per gallon if the beer was honest beer. The strongest honest beer that could be brewed would only contain 22 grains of salt per gallon. The Bench thought it was a case in which a small penalty should be imposed by way of caution. They fined defendant 1s. and £1 2s. costs.

Adulterated Butter.—Joseph Jordan, William Sawyer, and Edward Cobley, grocers, Rotherhithe, appeared to summonses charging them with selling butter which, on being analysed by Dr. Muter, contained from 70 to 80 per cent. of animal fat, but no appearance of butter. In the first two cases printed notices were put on the butter, "Sold at 1s. 2d. per lb.;" and in the third case the defendant pleaded that when asked for butter at the price named, he told the man who was sent by the inspector to make the purchase, that it was not butter, but "butterine;" and that on the man asking him what "butterine" meant, he told him he knew as well as he did himself.—The Magistrate imposed fines of 20s. and 2s. costs in the first two cases, and dismissed the third summons, as information was given to the purchaser, before the purchase was made, that what was sold was not butter.

Important Case.—At the Manchester County Police Court lately, Thomas Beswick, farmer, Toft, near Knutsford, was summoned for having sold milk not of the substance and quality demanded. Mr. Gardner, who prosecuted on behalf of the Milk Dealer's Protection Society, said the complainant was a milk dealer in Salford, and the contract for the delivery of milk to him from the defendant was made at Old Trafford. The milk in question consisted of eight gallons. Whilst the milk remained in the defendant's can, Mr. Owen, secretary to the Society, took three samples. It would be shown that there were about eight parts of cream abstracted more than was usually allowed by analysts. That was the second time the defendant's milk had been tested and found wanting. One of the Magistrates wanted to know if Mr. Gardner could inform him of the minimum amount of cream in milk? Mr. Gardner replied about 30 per cent. The Magistrate said that this must be in excess of what possibly came from the cow. Mr. Gardner: The defendant's milk ought to have contained eight per cent. of cream above what was actually found in it. The Magistrate: Was the milk impure? Mr. Gardner: We do not charge him with selling impure milk, it is with extracting the cream therefrom. The article was not of the substance demanded. The Magistrate: Has there been any case decided on this point before, I never heard of such a case. The magistrate's clerk said he never heard of a similar case. Another Magistrate, to Mr. Gardner: Do you mean when the cream was taken off that it was skimmed milk? Mr. Gardner: Instead of having sold new milk he sold an article from which the fatty matter had been extracted. In fact it was what was called "blue" or skimmed milk. Evidence having been given in support of the case, the magistrates after a short consultation, dismissed the charge on the ground that a private instead of a public analyst, as required by Act of Parliament, had been employed in the matter.

Castor Oil Pills.—At the Lancaster Police Court, on the 15th March, R. Taylor, manager of the Carnforth branch of the Lancaster, &c., Co-operative Society, was charged with selling, to the prejudice of the purchaser, a box of pills, purporting to be "Compound Castor Oil Pills," which were not of the nature and substance demanded. Mr. W. Sharp appeared in support of the information, and Mr. Byrom defended on behalf of the manufacturers of the pills, Messrs. Bell and Sons, chemists, of Liverpool. The case was before the Bench on the 1st instant, but was adjourned, in order that Dr. Campbell Brown might be cross-examined upon his certificate. Mr. Sharp said it would be remembered that upon the last occasion Supt. Moss gave evidence that he went on a certain day to the Store at Carnforth, and there saw defendant, and asked him whether he had got any castor oil pills, and that defendant replied, "Yes, plenty." The Superintendent then asked for a box, and was supplied with what was described as castor oil pills, for which he paid one penny. He told defendant that he had purchased them for the purpose of analysis, and asked him whether he wished to have them divided, but defendant declined, and said he had plenty more. Mr. Sharp here read a paper wrapped round the box of pills, in which their qualities were highly extolled, and were designated "Compound Castor Oil Pills."—Dr. Campbell Brown's certificate was in these terms:—I am of opinion that the said sample is made up entirely of the following ingredients: Rhubarb, aloes, ginger, some kind of pepper, probably cayenne, soap, saccharine matter, resinous matter, and that they contain no castor oil.—Dr. Campbell Brown was then examined: He said he believed there were eight pills in the box sent to him, and he analysed three or four of them, and sent back the certificate produced to Supt. Moss. The principal ingredients of the pills were aloes—in round numbers it would be about one-half aloes; in addition, there was a little rhubarb, cayenne pepper, he thought, cloves, and some aromatic spices of that kind, soapy matter and some saccharine matter, probably Spanish root or something of that sort. He examined those pills for castor oil, and there was no appreciable quantity of castor oil in them. He did not mean to say that if he had analysed 1lb. of pills he might not have found a trace of castor oil, but it would not be sufficient to be appreciable in three pills, much less in one, and practically there was no castor oil in them. Aloes is not such a safe medicine as castor oil, because that is an aperient medicine which can be given safely in delicate cases. Persons recovering from fever and inflammation, and so on, are always ordered castor oil; and aloes to such people would be an injurious medicine, because of its violent action upon the lower bowels; it would be an injurious medicine in other cases also. Many people cannot take aloes, and they know it. Some females, and also people suffering from piles, would be injured by aloes. Those pills did not answer the description of "Compound Castor Oil Pills?" They are compound aloes pills. They might be called compound rhubarb pills, but the principal ingredient being aloes, they ought to be called compound aloes pills—or at least I will not go so far as that, but the label ought to state that they contained aloes. Cross-examined, Dr. Brown said: I am of opinion that the pills contain no castor oil, but if you say castor oil was used in making up the compound I will believe you. If it is used to the extent of 1·5 or 1·75 per cent. in each pill, I should call that nothing whatever. I am quite sure there was not 5 per cent. If you say there was 1·5 or 1·75 per cent. in each pill, that would be something like ·02 of a grain, and if it was only to the extent of ·02 of a grain in each pill there is no test I know of by which it could be discovered. If I had had two or three pounds of pills I might have extracted sufficient castor oil to be recognised. If it was distinctly stated on the label that the pills contained aloes a great deal of my objection would be removed. He had heard of pills made by a certain firm and sold at 1s. 1½d. per box as castor oil pills; if they are protected by the Government three-halfpenny stamp, it only proves that the Government stamp is made the means of covering a good deal of injurious sale of drugs. There have been similar cases to this one brought forward in which there have been convictions. Respectable druggists refuse to sell anything under the name of "Castor Oil Pills;" they sell castor oil capsules.—Mr. Byrom having addressed the Bench for the defendants, Dr. Page, of Kendal, was examined, and said he had examined the specifications of the pills named, and found they contained only a slight amount of castor oil. In the absence of a division of the contents of the box purchased, he was bound to admit that the ingredients mentioned by Dr. Brown were found by him. The whole of the ingredients were such as were given by authority of the Medical Council, as ingredients all of which were in daily use for the relief of constipation and those ingredients were not supposed to have any "specific" effect. They were, in his opinion, non-injurious. He considered that the name "Compound Castor Oil Pills" was justifiable. It was named in accordance with the principles of pharmacy, and it was also properly named on the ground that it was the usage of pharmacy to name a pill after any ingredient irrespectively of the active quality of the ingredient or the quality. Mr. Collins, analytical chemist, of Bolton, said he had long known there were such things as castor oil pills sold. He supposed they would contain castor oil; in some cases a very trifling quantity and in others a mere trace. He presumed they arrived at their present name owing to their giving similar results as a dose of castor oil. He believed a firm at Leeds were the the first makers of those pills. If they relied on the pills to get as much castor oil as went to a dose, they would have to take from 400 to 600. He could not say anything as to the effect of the pills as he was not a medical man, and where doctors disagreed it was sometimes unpleasant to interfere. Castor oil was quoted in that morning's paper at 8½d. per lb., the other drugs were much more expensive. There could therefore be no idea of fraud, otherwise the largest quantity would be used of the cheapest drugs. Cross-examined: he had examined a great many of these pills, and as rule he found them to contain castor oil. He analysed from 20 to 30 pills. He found 1·35 per cent. of castor oil. If he had had two or three pills only he could not have found castor oil. After a brief consultation, the Chairman announced that the Bench were of opinion that there must be a conviction. The penalty would be 40s. and £8 5s. 4d. costs. Mr. Byrom gave notice of appeal, which, we have been informed, has since been abandoned.

NOTES OF THE MONTH.

We do not envy the position of the gentlemen who may be appointed on the Select Committee of the House of Commons on the new Sale of Food and Drugs' Amendment Bill, for already there are signs that they will be flooded with crochets from every direction. The trade societies are already moving, and will do all they can to get knowing little clauses introduced, to further hamper the working of the Act, under the pretence of the protection of innocent traders, while, on the other hand, the medical men and others, who know the danger of impure food and drink, will be doing their best to extend its provisions.

Already signs of the latter movement are apparent in the action of the British Medical Association, who desire to see water included in the Bill. As a body the analysts are quite ready and willing to accept this extra duty, provided the fee for a sanitary analysis of water be fixed at £1 1s.; but it would be impossible for any man to honestly give a report on any water for the present Act fee of 10s. 6d., as it would not meet his expenses, and even the proposed £1 1s. would only be remunerative in cases where the analyst receives a salary in addition to the fees.

Among the trade movements we specially find that of the Chemists' Defence Association, who desire to force vendors to have a sample whether they will or not, and further to give the defendant power to always insist on the personal attendance of the analyst in court, instead of, as at present, accepting the certificate as evidence, unless in disputed cases. To the first proposition we have nothing to say, because it makes no difference to us whether a sample be left or not, as there is always the official sample in the hands of the inspector to check such cases of tampering with the tradesman's sample, as have already occurred. But we trust that our Legislature will pause before they lay down the rule that the analyst is to be dragged, perhaps many miles, to court in every petty case, merely so that it may give him inconvenience, and cost the authorities his court fees and travelling expenses. Already there is the most ample provision for the citing of the analyst in any disputed case, and, indeed, under such circumstances, a man whose work was attacked would only be too anxious to come forward in his own defence. To insist upon the continual production of the analyst will be to put another break on the wheels of the Act, and another charge on the public purse, both of which are sufficiently clogged and taxed respectively as it now stands.

The real fact is that the Act, as it stands, is good enough, provided its wording be made a little clearer to remove the "prejudice to purchaser" difficulty, and above all that definite standards be fixed for all disputed articles. It is on the point of names and standards that nearly all the failures of prosecutions have occurred, and the position of analysts is simply this:—They say fix what standards you like, be they high or be they low, but either at once give us standards like those *proposed* to be provided for spirits, or appoint some central authority, say for instance the Council of the Society of Public Analysts, to provide such standards, which when duly approved by the Privy Council, shall become bye-laws under the Act, and so binding on everyone concerned. There is no branch of trade where definite standards and names are more wanted than in the drug business. These traders pretend to use the British Pharmacopœia, but whenever it suits their purposes of defence overboard goes that authority, and "custom of trade" reigns supreme.

In a letter we publish Mr. Angell's vindication, upon which we offer no more remarks, as we wish to avoid internal dissensions. We made our comments, because it appeared there must be some screw loose where a tradesman was prosecuted for what had already been held to be no adulteration. We are particularly sensitive on this point, owing to the readiness with which our natural enemies, the trade journals, would seize it, to be a ground of abuse upon analysts generally.

Mr. J. Carter Bell has been appointed public analyst for the borough of Glossop, vice Allen resigned.

Mr. Francis Vacher has been appointed public analyst for the borough of Birkenhead.

Dr. Bostock Hill has been appointed public analyst for Leamington, vice Dr. Thompson resigned.

Mr. J. Vincent Taylor has been appointed public analyst for Colchester.

Mr. J. Baynes has been appointed public analyst for South Lincolnshire.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price
3008	F. M. Lyte...	Purification of Chloride and Sulphate of Zinc	2d.
3043	J. Duncan & J. A. R. & B. E. R. Newlands...	Treatment of Sugar	4d.
3049	Ditto	Treatment of Saccharine Substances or Compounds	4d.
3079	J. Mactear ...	Manufacture of Soda and Potash...	4d.
3125	W. R. Lake...	Apparatus for Concentration of Sulphuric Acid	2d.
3166	H. Brunner...	Manufacture of Alkali	4d.
3182	R. Lavender & J. Richards	Treating Waste Sulphuric Acid ...	4d.
3228	E. G. Brewer	Apparatus for Manufacture of Hydrogen Gas	2d.
3246	C. F. Clans ...	Manufacture of Sulphide of Zinc...	4d.
3257	F. C. Hills ...	Manufacture of Sulphate of Ammonia	4d.
3297	J. Wilkes & T. Johnson	Purifying or Refining Copper	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Anti-Adulteration Review; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Our Domestic Poisons, by Henry Carr, M. Inst. C.E.; The Hygiene of the Skin, by J. L. Milton; Le Praticien.

Mr. E. W. T. Jones' letter on the question of butter analysis reached us too late for insertion in this number.

ERRATA.—In Mr. Collins' letter in our last number, line 15 the figures should read "Then 9·37—(2·9+3·1+·57)=2·8."

THE ANALYST.

SUPPLEMENT, APRIL, 1879.

PREJUDICE TO PURCHASER QUESTION.

Special Report of the Arguments and Judgment, in the case of Hoyle *v.* Hitchman, on appeal from the decision of Sir James Ingham, (see The Analyst, vol. 3, pp. 368 and 386.)

QUEEN'S BENCH DIVISION.

(Sittings in Banco, before Mr. Justice Mellor and Mr. Justice Lush.

Hoyle Appellant—Hitchman Respondent.

MARCH 27th.

This was an adulteration case, which raised a very important question. It was an appeal by an inspector of nuisances against a decision of the magistrate dismissing a complaint against a milkman for adulteration under the Adulteration Act of 1875, and the object of the appeal was to raise the question whether, where, as in almost all cases where officers make such complaints, they have purchased, not for their own consumption, but for the purpose of analysis and prosecution, the complaint is to be deemed to fail on the ground that he is not "prejudiced" within the terms of the Act. The case was sent to this Court in order to obtain a decision on this question which has for some time perplexed the magistracy, and practically interfered with the enforcement of the Adulteration Act—a question arising out of the introduction into the Act of 1875, of words which require that the sale of the adulterated article shall be "to the prejudice of the purchaser." The enactment, as Mr. Justice Lush observed in his judgment in this case, "has given rise to a division of judicial opinion which has, it is to be feared, very much crippled the operation of this most useful Act." Seven of the Scotch Judges in a case of a sale of cream had been divided in opinion, several of them holding that the words referred to excluded cases in which the purchase was made by a public officer—a view which practically would exclude most cases from the operation of the Act, as most prosecutions are initiated by public officers; and on that very ground—that such a view would virtually nullify the operation of the Act—most of the Scotch Judges in that case dissented from it, and though a majority (five out of seven) came to a conclusion adverse to the prosecution, two at last went upon other grounds, so that, as two dissented altogether, a majority did not adopt the view in question. As, however, the cases in the Scotch Courts are not, of course, reported in this country, and the Scotch Law Reports are not generally accessible, all that was known was that the Scotch Supreme Court had dismissed a prosecution by a public officer, and the impression was that they had done so on the ground that a purchase by a public officer could not be "to the prejudice of the purchaser." In a case which came before this Court last year—a mustard case, in which also the purchase was by an officer—the question as to the effect of those words came before this Court not only in that way, but also in this way—that it was set up as a defence that it was very well known that mustard was mixed with flour and other things, so that the purchase could not be to the "prejudice of the purchaser:" and though on the former point one of the Judges (Mr. Justice Lush) expressed an opinion that it was not material that the sale was to an officer, on the second point, which equally involved the meaning of the words in question, the Court sent the case down to be re-stated; and as it was impossible to deny that it was commonly known that mustard was mixed and adulterated, the case never came up again before the Court, and the view taken by the Court was probably fatal to the prosecution. The question again came before this Court, on both points, in a case of "Sandys v. Small," June 26, 1878, heard before the Lord Chief Justice and Mr. *Justice Mellor.* There the case was a sale to an inspector of whisky alleged to have been mixed with water, and the defence set up was that it was known to be so mixed, and so was not a sale "to the prejudice of the purchaser," and the Court so held; and as they were against the prosecution on that point it was not necessary to decide the other, though the two points were shown to be closely connected in the course of the arguments, for it was pointed out that in most cases purchases for the purposes of prosecution were by public officers, who only made such purchases in cases where they had reason to believe and did believe that the articles sold were adulterated and were commonly adulterated, and that in such cases the officers did not purchase for consumption, and probably did not consume any part of what they purchased. The Lord Chief Justice was supposed to have said, in answer to that argument, "If the officer does not consume the article, how is he prejudiced?" it being admitted that in such cases the officers do not pay the price out of their own pockets; and, in fact, in that case, as already stated, the decision was that the prosecution failed because the purchaser was "not prejudiced." Whether or not the observation of the Lord Chief Justice had anything to do with the decision, it certainly has since received the sanction of a considerable weight of judicial authority, for in a case of "Davidson v. M'Leod" some of the Judges of the High Court, after a second argument, arrived at the same conclusion—that where the officer, not purchasing for his own consumption, has not been actually prejudiced, the case must be considered to fail. Thus the impression was produced on the minds of the magistracy that this Court, as well as the Scotch Court, had held again and again that the sale must be "to the prejudice of the purchaser" personally, and that if he neither paid for nor consumed the articles purchased, it could not be said that he was "prejudiced"; and in consequence of this impression many of the magistrates had declined to convict, almost all cases, as already stated, being purchases by public officers. The present case was one of them, and was brought before the Court in order to determine the question, on which it was said the whole operation of the Adulteration Act practically depends, most prosecutions under the Act being instituted by officers, and few of the poorer classes most likely to be imposed upon by adulteration being disposed to incur the necessary expenses of a prosecution. In the present case the question had arisen thus:—1. The respondent Hitchman was summoned on the complaint of Hoyle, an inspector under the Sale of Food Act, 1875 (38 and 39 Vict. cap, 63), for that he "on the 13th of September, 1878, within the Metropolitan Police District, did sell to the prejudice of the said John Hoyle, a certain article of food—to wit, milk, which was not of the nature, substance, and quality of the article demanded by the said John Hoyle, contrary to the statute 38 and 39 Vic., cap. 63. 2. On the 4th day of October last the case was heard by me, Sir James Ingham, the chief magistrate of the police-courts of the metropolis. 3. The appellant was the inspector of nuisances of the Board of Works for the St. Giles's district, in the county of Middlesex, and was also the inspector duly appointed under the 13th section of the Sale of Food and Drugs' Act, 1875. He went on the 13th of September last to the respondent's shop and asked for half-a-pint of milk, and upon being told that the price was 1½d., he paid that sum out of money belonging to the said Board, for which he had to account, and took possession of the milk. Directly after the purchase was so completed, he told the respondent's shopman that he was an inspector of nuisances, and an inspector under the Sale of Food and Drugs' Act, 1875, and that it was his intention to have the milk analyzed by the public analyst, whom he named. 4. He then offered to divide the milk into three parts, and did, in fact, so divide it, and sealed up such parts as required by the Act. One part he delivered to the shopman, and the remaining two parts he took away with him and delivered one of them to Dr. Redwood, the public analyst, and produced the third part before me on the hearing of the case. 5. The milk so purchased was found by the public analyst to contain 76 parts milk, and 24 parts water, which water had been added to the milk after it came from the cow. 6. On cross-examination by the respondent, the appellant stated that he was not prejudiced, and that no injury had been done to him personally. 7. The respondent submitted to me that no offence had been established under the 6th section of the Act, as the milk sold was not sold to the prejudice of the purchaser. 8. I found that the appellant demanded milk; that the article sold was not of the nature, substance, and quality of the article demanded, as it was, in fact, milk and water, and not milk; that the appellant at the time when he purchased the milk had no knowledge as to whether the milk which the respondent sold to him was adulterated or not; that no notice of any kind was given to him that the article sold was milk and water and not milk. Had the purchase in this case been by one of the ordinary customers of the respondent, the offence mentioned in the Act, would, in my judgment, have been committed. 9. I, however, dismissed the summons, because I thought that, although the appellant did not get the article he paid for, the sale was not, in the circumstances mentioned, a sale to the prejudice of the purchaser within the meaning of the Act, as the milk was purchased by an inspector for the purpose of analysis only. 10. The appellant duly required me in writing to state a case for the opinion of this honorable Court, which I now do. The question for the opinion of this honorable Court is whether I was right in point of law in dismissing the summons. If I was wrong, I pray this honorable Court to remit the case to me with its opinion thereon, so that I may impose such a fine as, in the circumstances of the case, I may deem just."

Mr. Poland, for the appellant, argued that if a complaint otherwise well grounded could be dismissed on such a ground, the Act would be virtually nugatory, as no one but a public officer was likely to buy a pennyworth of milk for the purpose of analysis. No doubt the words were introduced into the Act, "to the prejudice of the purchaser;" but the only effect was to exclude a case in which the mixture was not to the prejudice of the purchaser.

Mr. Justice Lush pointed out section 13, providing that inspectors might purchase articles for the purpose of analysis, and several subsequent sections providing for prosecutions by inspectors.

Mr. Morton Smith, in support of the magistrate's decision, said it had proceeded upon the authority of the observations of the Lord Chief Justice in the case in this court, and also the decision of the Court of Sessions in Scotland in a similar case to the present, in which five out of seven Judges reversed the conviction. But it appeared that there it was not alleged that it was "to the prejudice of the purchaser;" nor could it be, the article purchased having been cream, and the purchaser having got cream, though of an inferior quality.

Mr. Justice Lush referred to the regular law report of the case in this Court, whence it appeared that in that case the article was known by the purchaser to be mixed.

Mr. Justice Mellor observed that the view taken by the magistrate seemed to make nothing of the provisions in the Act for purchases of articles for analysis by officers and inspectors.

It was answered that these provisions were confined to cases of adulteration not injurious to the public health; but

Mr. Justice Lush said he could not so read the Act. The effect of the words "to the prejudice of the purchaser" was only to require that the article should be deteriorated by the mixture. According to the contrary view, any benevolent person purchasing a quantity of arrowroot or other nutritive article for the sick might be imposed upon by adulteration to any extent with impunity, for the purchaser not himself using the article would not be prejudiced, and those who were prejudiced were not the purchasers. That was the way in which to undermine the operation of the most useful Act of Parliament.

Mr. Poland, in reply, referred to the report of the case in this Court in the 47th "Law Journal." He also cited the case of "Sandys v. Markham," 41 "Justice of the Peace," p. 52, (January 27, 1877), the "mustard case," where the objection was taken that the purchaser, an officer, purchased only for analysis, and also that mustard was known commonly to be adulterated, and the case was sent back to the magistrate to be re-stated on the latter point, but Mr. Justice Lush expressed an opinion adverse to the first objection. The case never came before the Court again. No case in this country had decided that if the adulteration was shown, it was a defence that the purchaser did not purchase for his own consumption. As to the Scotch case, two of the Judges dissented, and the other five differed a good deal in their grounds and reasons; and that, moreover, was not a case of adulteration, but simply a case of poor cream.

Mr. Justice Lush observed that it might be that the decision was quite right, and also quite consistent with a different decision of the present case.

Mr. Poland said that was so, and proceeded from the report to point out that at least two Judges out of the five went on that ground; and as two dissented from the decision, it followed that only three out of the seven rested their decision on the words "to the prejudice of the purchaser," and the majority of the Judges were adverse to the view of the words now suggested. Moreover, the decision partly rested on the ground that it was not alleged that the purchaser was prejudiced, and that he could not have been, as he asked for "cream," and got it.

Mr. Justice Mellor.—You do not, therefore, contest the decision? Mr. Poland.—No, nor the opinions of the majority of the Judges.

Mr. Justice Lush.—There was no admixture of foreign matter in the cream in that case. Mr. Poland.—No.

Mr. Justice Lush.—It was only a case of poor cream. Devonshire cream is richer than the cream furnished by the cows in other counties. I dare say Mr. Morgan Lloyd will not be offended if I venture to suggest that Alderney cows may furnish richer milk than Welsh cows. Mr. Morgan Lloyd.—My Lords, no doubt there are cows and cows in Wales as in other countries.

Mr. Justice Mellor said in the Scotch case there was no mixture of foreign matter with the cream, and he saw no ground for dissenting from the actual decision in that case, however he might dissent from the reasons given by some of the Judges. However, the Court felt it was due to the Scotch Judges to pay them the respect of carefully reading and considering their judgments, and, therefore, the Court would take time to consider their judgment.

MARCH 28TH.

Mr. Justice Mellor, in giving his judgment, having read the enactment and stated the effect of the case, said,—The only ground on which the magistrate had dismissed the complaint was that the purchaser was not "prejudiced" by the sale of the milk to him. That gives rise to the question whether the "prejudice" contemplated by the 6th *section* is a pecuniary prejudice. Such a view of the Act would, in my judgment, absolutely nullify its beneficial effect. For if the meaning of the enactment is that the offence cannot be complete without its being "to the prejudice of the purchaser," it is hardly possible that the offence should be brought home to any one. And this observation, in my view, goes far to show that this construction cannot be the right one. So far as authority is concerned, there is no direct decision in favour of such a view; and indeed, in the English Courts, there is hardly any authority upon the point. For in the first of the two cases in this Court referred to, the mustard case, my brother Lush, distinctly said that, in his view, if the article were adulterated, it must be presumed that it was "to the prejudice of the purchaser," and I could not have dissented from that opinion or I could not have concurred in sending the case down to be re-stated on the other point. And as to the other case, no doubt in the course of the argument the Lord Chief Justice made some such remark, but not by way of a decided *dictum*, and rather by way of query or suggestion, and the decision went upon the other point, so that there is no authority in the English Courts in favour of the view now presented. There is, however, the decision of the Court of Session in Scotland, and if the Judges had concurred in that view we should have been reluctant to give a decision contrary to their judgment. But, out of seven Judges, two of them dissented from the decision altogether, and two more appear to have declined to adopt this view, so that the majority of the Court do not appear to have adopted the view now presented to us, and (if I may presume to say so) I am not prepared to say that their actual decision upon the case before them was erroneous; indeed, the inclination of my mind is to go along with the majority of the Scotch Judges in the conclusions they arrived at. But two, at least, even of the majority who concurred in the decision appear to have dissented from the view that pecuniary prejudice to the purchaser is essential to constitute the offence, and one of them said that such a view would nullify the operation of the Act. Therefore, in this diversity of opinion as to the meaning of the words "to the prejudice of the purchaser," it cannot be said that the weight of judicial authority is against, and I rather think it is in favour of, the view which we have arrived at after the best consideration given to the question as to the true construction of the enactment. It is quite general in its terms, and its terms are very large, nor is there anything to limit them,—"if any one shall sell, to the prejudice of the purchaser, any article of food not of the nature, substance, or quality of the article demanded by the purchaser." There is nothing to limit the application of the enactment (as some of the Scotch judges seem to have supposed) to articles deleterious in their nature. And in several of the sections (13 to 17) provisions are made for purchases by public officers for the purpose of analysis and prosecution, assuming that if the article is found to be adulterated the offence will have been committed. It would be strange indeed if all these provisions were to be made nugatory by a construction which would, in effect, come to this—that proceedings could only be taken by private individuals. Here the purchase was made by the inspector under those sections; but surely the case must be treated as though the purchase had been by a private individual. Now, in the case of a private individual no one could dispute that in such a case as this the offence would have been completed, and the magistrate has so found, in fact. That being so, what difference can it make as to the nature of the offence that the purchase was by an officer on behalf of the public and furnished with public money for the purpose? If the purchaser asks for a certain article, and gets an article which by reason of some admixture of a foreign article is not of the nature or quality of the article he asks for, he is necessarily "prejudiced;" and how can the fact that the purchase is not with his own money at all affect the question of the commission of the offence? The offence intended to be prevented by the Act was the fraudulent sale of articles adulterated by the admixture of foreign substances which would necessarily be "to the prejudice of the purchaser;" and those words were inserted only to require that such an adulteration should be shown to have been made. Taking all these matters into consideration, I cannot bring my mind to the conclusion that in such a case as this the offence is less complete merely because the money with which the purchase was made was not the money of the purchaser, which must be wholly immaterial to the seller and cannot affect the offence he has committed. I come, therefore, to the conclusion that the magistrate was wrong in dismissing the case on that ground, and, therefore, that the case must be remitted to him to be determined on the evidence as to the offence alleged to have been committed.

Mr. Justice LUSH, in expressing his entire concurrence, said that the differences of opinion which unfortunately prevailed as to the true construction of the 6th section of the Act had crippled the operation of a most beneficial Act.—Judgment for the appellant.

The Select Committee on the Sale of Food and Drugs' Act (1875) Amendment Bill met on the 28th ult., and appointed Mr. Sclater-Booth chairman. The Committee will sit on Tuesday, the 1st instant, at one o'clock.

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THE ANALYST.
MAY, 1879.

THE SALE OF FOOD AND DRUGS ACT.

The recent decision of the Queen's Bench Division of the High Court of Justice, in the case of Hoyle *v.* Hitchman, was given at such a late date that we could not comment upon it, although we published the judgment itself and a considerable portion of the arguments in the special supplement which was issued with our last number.

It is fitting, therefore, that we should now make a few remarks upon a decision, which, as the *Times* says, "has laid a troublesome phantasm which was disturbing the operation of a very useful statute," although we, no less than the *Times*, "are grateful." We have uniformly expressed the opinion that this was the decision the Court of Queen's Bench would arrive at, and it is the more satisfactory to know that it was given not merely on the particular case at issue, (which was one of adulterated milk containing 25 per cent. of water); but that previous judicial remarks and so called decisions were fully reviewed and referred to in the judgment. Some of the remarks made by Mr. Justice Mellor are of such importance that it is worth while to draw special attention to them: he said, "if the meaning of the enactment is that the offence cannot be completed without its being to the prejudice of the purchaser, it is hardly possible that the offence should be brought home to anyone;" and further, "it would be strange, indeed, if all these provisions were to be made nugatory by a construction which would in effect come to this—that proceedings could only be taken by private individuals;" and again, "I cannot bring my mind to the conclusion that in such a case as this the offence is less complete merely because the money with which the purchase was made was not the money of the purchaser, which must be wholly immaterial to the seller, and cannot affect the offence he has committed."

The judgment, therefore, is given entirely on the broad ground that if the decision of Sir James Ingham were allowed to stand, the Act would be rendered entirely inoperative, which certainly was not the intention of the legislature at the time the Act was passed. Mr. Justice Mellor, in his judgment, also points out one thing on which no special stress had been previously laid, viz., that in the Court of Sessions in Scotland, out of seven judges two dissented altogether from the well-known decision, and two others appear to have declined to adopt the view of the remaining three in reference to the "prejudice" question, so that the majority of the Scotch Court was actually of the same opinion as Justices Mellor and Lush.

The introduction of an Amending Bill into the House of Commons, and its reference to a Select Committee, affords us a suitable opportunity to refer to two or three other points in connection with the working of the Act. We have often pointed out before that defences to prosecutions, under the Sale of Food Act, very frequently take the form of detecting flaws of some sort or other in the Act itself. When a man is charged with a misdemeanour of an ordinary kind, the ingenuity of his professional advisers naturally takes advantage of every opportunity of proving him technically innocent rather than guilty; but it is somewhat unusual to find the actual meaning, or intention, or scope of an Act of Parliament challenged, unless the prosecution is taking place under the Sale of Food Act. Yet anyone who would take the trouble, as we have, to examine the records of disputed cases during the last four years, would be struck with the fact that in a very large number of cases the defence has been—not that the analysis was incorrect—not that the sample had been purchased from any other shop—not that the inspector had tampered with it; but in some ingenious way seeking to prove that the prescribed formalities of dividing, labelling, sealing, and so on, had not been fully complied with. Some of the trade journals who have adopted a virulent tone towards Public Analysts generally, say that disputed cases are frequently due to analytical blunders; but it is a singularly significant fact that out of some 50,000 samples examined by Public Analysts during the last four years, only somewhere about one per thousand has been sent to the chemists at Somerset House for a second analysis, and this, notwithstanding the well-known fact that in certain cases, such for instance as milk, those chemists have adopted a standard lower than is justified by the experience of Public Analysts themselves, or by the large number of analyses published by chemists of repute; and it is still more significant that in about half the cases which have actually gone to Somerset House the chemists there have confirmed the results of the Public Analysts, and of the remaining half of the cases their report has frequently been simply equivalent to giving the benefit of the doubt to the vendor—that is, they were unable, owing to the lapse of time or from some other cause, to say whether the sample was adulterated or not.

Such a state of things as this is satisfactory as regards the Analysts themselves, and as regards the Queen's Bench decision; but when viewed in connection with the proceedings taken when the 1875 Act was before parliament, and the character of some of the clauses in the Bill now before the Select Committee, it may have a still more important bearing. It will be in the recollection of most of our readers that when the present Act was introduced into the House of Commons, after the report of the 1874 Select Committee had been presented, a suggestion was made on the part of our Society that a schedule, defining the strength and composition of certain articles, should be introduced into the Act. This schedule was not drawn or put forward with a view to reach any abnormal standard of either quality or purity in the articles referred to in it; but after long consideration and full discussion by members of the Society, it was so arranged as to cover every fair natural variation in the quality of those articles, so that for instance, no genuine milk, derived from a healthy cow, should be condemned under it, while for the same reason the better class of articles, whether milk, or cocoa, or coffee, would allow of some considerable amount of dilution or adulteration before they would reach the limits of the standard fixed. On the other hand an endeavour was made to fix the standard sufficiently high to prevent absolutely reckless sophistication by other means than the mere addition of foreign ingredients, that is, to prevent the produce of starved and diseased cows from being passed off on the public as genuine milk, and it is precisely on such points as these that the schedule to the Act was most needed, and that the so-called protection intended to be afforded by the Inland Revenue Chemists has proved to be worse than useless.

Viewed in the abstract, the proposition of the Society simply amounted to this: that whereas certain substances, as sold, differ slightly in quality even when genuine; and whereas certain tradesmen, less scrupulous than the majority, taking advantage of this fact, were in the habit of reducing the goods they sold still further, that, therefore, this schedule (with any alterations which might be made in it) should be taken to define what was the lowest strength of any substance permitted to be sold as an article of food unless that substance were labelled as a mixture. The adoption of some such schedule as this, even if the figures suggested by the Society had not been followed in their integrity, would, in our opinion, have rendered the Act much simpler, and it would certainly have obviated all necessity for referring to such a point as the "prejudice of the purchaser," because a minimum strength being given in every case it is practically certain that every shopkeeper would work as nearly as he could to that minimum strength, unless he secured an increased price for an article of better quality. The Act being thus rendered simple and much more effectual, tradesmen, instead of being in doubt as they are now as to what is legal, would have had a certain defined standard to work to, and thus all dispute as to what was and what was not adulteration would have been prevented, because a legal standard having once been fixed there would practically have been no difference between the results obtained by one Analyst and another on any given sample.

However, in 1875, the opinion of the legislature was adverse to any such schedule, and consequently the views of the Society were passed over, and until the introduction of the present Bill, which bears the names of Messrs. Anderson, Taylor, and Whitwell, there has been no attempt to give any schedule of any kind. Now, however, one is introduced relating to articles as to which a standard is specially needed, and from the discussion which took place before the Select Committee to whom the Bill was referred, it seems likely that this partial schedule, as to spirits only, will be adopted. Although the Committee's Report is not published, yet we understand that they will advise that all spirits, except gin, be allowed to be sold at 25 U.P., and gin at 35 U.P. Should this prove to be the case it will be, in more respects than one, a satisfactory step, because it will not only be the first adoption of the principle of definite standards, but it will relieve Public Analysts of a difficulty which has for some time past prevented any satisfactory certificates from being returned in reference to spirits.

But a singular anomaly will yet remain in the Act. Milk is the substance which, after spirits, most requires that a standard should be fixed for it, but here we could scarcely expect at present to meet with uniformity of opinion; without going over old ground, it is notorious that there is a difference of several per cent. between Analysts and the Somerset House Chemists. Our experience, and it is by no means small—since Public Analysts examined during 1878 more than 5,000 samples of milk—goes far to confirm the standard adopted by the Society some years ago, and we believe it is true that Mr. Bell and his coadjutors are gradually seeing their way to raise their figures slowly though steadily to those adopted by the Society.

But leaving this moot point, it certainly seems to us that drugs might fairly have been considered worthy of a place in this Amendment Bill, and that, if a standard were to be fixed for spirits, the Pharmacopœia might also have been taken as a standard for drugs. The subject was mentioned before the Committee, though not by this Society; but we learn that the Committee appear not to see their way at present to accept either the Pharmacopœia or any other standard as being a fit and proper standard for drugs. Therefore, Public Analysts will have to work as hitherto, according to their own judgment, guided by the information given in the Pharmacopœia, and using their discretion in each case as to whether a sample should be returned as adulterated or not. This seems to us specially unfortunate—no less so to the chemists and druggists than to the Analysts, because both are still left in the same position of uncertainty. We cannot at all agree with the opinion expressed by Mr. Bell on this point, when he stated that his objection to the Pharmacopœia as a standard was that every Analyst would use it as a hard and fast line, and that before such a standard as that was taken it ought to be referred to the Pharmaceutical Society to know if they had anything to say to it. Broadly, this means, if it has any meaning at all, that Mr. Bell thinks that the Pharmaceutical Society, after having put forward the Pharmacopœia for years as their recognised standard, are, now that a proposal is made to test their goods according to it, to be asked first whether they wish to alter their standard. We can scarcely believe such an idea could have entered the minds of the Pharmaceutical Society, but rather that some idea as to the wholesale adulteration of drugs must have been prevailing in Mr. Bell's mind, in reference, for instance, to such drugs as the sulphate of quinine ? recently sent to India. We are quite certain that both parties would be in a far better position, with a definite standard laid down, than they are now, in cases in which a drug is found to be short of the Pharmacopœia strength.

We understand that the Committee also recommend that prosecutions should be instituted within twenty-eight days from the purchase of the samples, and also that samples for analysis may be purchased in "open places of public resort," which we suppose may be taken to mean streets and markets, in addition to the shops only which some magistrates have held are the only places at which they may now be purchased.

We cannot give the Bill in its amended form in our present number, but next month we hope to do so; and shall probably have occasion to refer to one or two other points likely to be brought up by it.

AN ANALYSIS OF COFFEE LEAVES.

By Otto Hehner, F.C.S.

Read before the Society of Public Analysts, on 19th February, 1879.

A sample of roasted coffee leaves, analysed by W. Stenhouse (Phil. Mag., 4, vii., 21), contained 1·2 per cent. of theine, 2·1 per cent. of total nitrogen, and yielded 38·8 per cent. of extractive matter, the infusion possessing a taste as of tea and coffee combined.

Having recently had a sample of the slightly roasted leaves, as used in Brisbane, Australia, handed to me, I have examined them with the following results :—

Moisture	10·29	Soluble.
Theine	0·29	
Soluble nitrogenous matter	5·10	
Soluble mineral salts	4·95	
Other extractive matter	19·81	
Insoluble nitrogenous matter	13·35	Insoluble.
Cellulose	34·51	
Chlorophyl, and other insoluble non-nitrogenous substances	7·83	
Insoluble mineral salts	3·87	
	100·00	
Total extractive matters	30·15	
Total ash	8·82	; of which is
Soluble	3·83	
Insoluble	4·99	; including
Sand	0·42	
Total nitrogen, by soda lime process	3·02	per cent.

The infusion contained much caffe-tannic acid, as well as some tannin and glucose, the latter probably derived from the decomposition of the tannin.

The amount of theine found is remarkably small.

The taste of the infusion, if it can be compared with anything, resembles that of a mixture of tea and tobacco, a taste invariably observed, as I was told by my informant, by habitual consumers of the infusion.

The leaves when burnt or roasted exhale a powerful odour of tobacco, and the vapours, when condensed on a glass plate, smell overpoweringly of tobacco juice. It is needless to add that the leaves were carefully examined with the microscope, and that they contained no particle of tobacco. The microscopic structure of the leaves presents nothing very remarkable, but the sheaths of the veins are most regularly undulated. The stomata are small and numerous.

Mr. J. Hughes said that, having lately visited Ceylon, where he saw Mr. Cotton who had sent a sample to one of the societies here, he was much interested in the analysis. Coffee leaves had already been prepared and exhibited with a view, if possible, for future use as a drink; the infusion was something like tea, and under some circumstances might be used as a substitute by persons living in the country. It is rather strong but very refreshing, especially after a long walk or ride.

PROPOSED AMERICAN ADULTERATION BILL.

By Dr. Muter, M.A., F.C.S.

In closing the discussion on the paper on the German Adulteration Bill, which Mr. Hehner read before the Society of Public Analysts on the 19th March last,* Dr. Muter said: Although I rise to conclude this discussion, I have yet really nothing to say as to the German Bill in addition to what has already been expressed, except to thank Mr. Hehner, in the name of the Society, for a most interesting communication; but, I have brought with me to-night the draft of a proposed law "to prevent the adulteration of food and medicine, and to create a State Board of Health" in the United States of America. This draft is in the form of a report to the Medical Society of the State of New York, and is published as a special supplement to the rising American journal known as *New Remedies*. It appears that for a year back the whole subject has been under consideration by a joint committee made up of representatives from the New York Academy of Sciences, the New York Academy of Medicine, the Medical Society of the County of New York, the Therapeutical Society, New York College of Pharmacy, New York Medico-Legal Society, the Public Health Association, and the American Chemical Society, and considerable time has been devoted to the examination of the subject; and two or three drafts of laws besides this have been prepared and submitted to discussion.

The report opens with critical remarks upon the defects of our "Sale of Food and Drugs Act," and the following is the summary of these weak points:—

First, the law must so clearly define the offence of adulteration in all its various forms, even by repetition in wording the definition where this may be useful, as to make the various forms of the offence plain to the understanding of the persons who adulterate, rather than by general definitions to leave too much to be decided only by litigation in the courts. If the offence be well defined to the person who adulterates, the first effect will be to prevent or deter him.

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* See Analyst, vol. iv., p. 62.

Secondly, the questions of intent to defraud, and of injury or prejudice to the purchaser of adulterated articles, either as to health or to cost, are carefully avoided, because in a definite, fully recognized shape they are often entirely wanting in the adulterator, and are always difficult to prove. A very large proportion of the adulterations practised are not attempts at fraud, nor designed to damage health, but are straining efforts to make money. And these efforts are so earnest and so intense, energetic, and absorbing as to leave all other considerations in the background. That the public is hurt and cheated is but an accident rather than a malicious intention. In place of these the adulterator is made responsible for the effects of his acts in their more definite and physical relations to the public; and to the penalties imposed upon them. The offence then consists in the act of debasement, which is so easily proven by the debased article. And a pleading of absence of intent to defraud, or of the harmless character of the debasement to the individual purchaser, would simply amount to a plea of ignorance of the effects of the offence, and would influence the courts—not so much on the question of conviction because the public offence of debasement has been committed—but simply as to the extent to which the adulterator should suffer in order to prevent others from similar acts through similar ignorance.

Thirdly, the making it the duty of the consumer who may be injured to prosecute the offenders (using the inspectors merely as witnesses in the prosecutions) has been carefully avoided, because it has been found that very few persons have either the inclination, time, or money, to give to such prosecutions, and that it is much cheaper for individuals to suffer than to prosecute.

To carry out the law, State Boards of Health are to be constituted, consisting of two physicians, one chemist, one barrister, and one eminent retired merchant, who are to be duly sworn to appoint analysts and inspectors, and carry out prosecutions. The analysts are to be bound to procure and examine ten samples of food and drugs each week, and to meet at stated intervals to discuss processes, and fix standards to be laid before the Board of Health for approval, and when so approved such standards are to be binding. All the reports of the analysts are to go before the Board of Health, and no prosecution is to take place, except by their orders, after consideration of the said reports. The offences are described with almost painful attention to *minutiæ*, and with what often savours of apparently vain repetitions. They are as follows:—

1. The adding of one or more substances to another or others whereby the strength, purity, quality, or true value of the resulting substance or mixture is reduced or lowered in its nature or composition with the effect of tending to deceive the public by lowering such substance or mixture from its original and true value, or altering the public significance and common meaning of the name by which it is or was originally known or used.

[Corn meal in flour; chicory, &c., in coffee; terra alba in cream of tartar; foreign substances in powdered opium.]

2. The substitution of one substance for another, either wholly or in part, with the effect of tending to deceive or mislead the public or any part thereof.

[*Artificial wines and liquors and mixtures*; artificial mustard; powdered colocynth seed for colocynth.]

3. The abstraction of any part of any substance with the effect that the separation shall reduce the value of the substance and thus tend to deceive or mislead by changing the common significance of the name by which, as a whole, the substance was originally applied to its use.

[Cream from milk, partly exhausted coffee, tea and drugs; thymol from oil of thyme.]

4. The application of a name commonly known or understood to indicate any substance, to any part or parts thereof, or to any other substance, with the effect of tending to deceive and mislead.

[Oleomargarine for butter; potato starch for arrowroot; dead oil for carbolic acid.]

5. The presence in any substance of any impurity, or any foreign matter that is either natural or accidental to it, if in unusual proportion.

[Dirt in all food and medicine; metallic salts in canned provisions.]

6. The admixture of different qualities of the same substance with the effect of tending to deception and fraud.

[Damaged wheat in flour; garden rhubarb in medicinal rhubarb.]

7. Any debasement or dilution of any substance whereby it is reduced in intrinsic value and is yet liable to be given, bought, sold, or used as though it was not debased or diluted.

[Diluted milk; diluted vinegar; diluted liquors; diluted medicines.]

8. Any coloring, coating, polishing or powdering or any other alteration in the physical condition or sensible properties of any substance, with or without addition to, or subtraction from it, whereby damage is concealed, or it is made to appear better or greater than it really is, either in quality, weight, or measure; or whereby impurity or defective quality is partially or wholly masked or hidden, with the effect of tending to deceive or mislead.

[Coloring and polishing of green coffees; powdering and coloring of damaged drugs; bread from damaged or mixed flour; "large" bread of short weight.]

9. The giving or selling or offering for sale, or the possession of any adulterated article by any person whose business it is to make or to deal in articles of food or medicine shall be *prima facie* evidence of the offence of adulteration. Provided that it be, and it hereby is declared to be, the sole and entire object and intention of this law to protect the public against deception and fraud in the cost and quality of food and medicine through adulteration. And all the provisions of this law shall be construed and applied in accordance with its sole object, by the rules of common law.

Whether these complicated provisions would work in practice is a grave question, and I am inclined to think that our own law, as it now stands, is both simpler and better. The only point which I consider to be a real improvement is the establishment of a Central Board of Supervision, charged with the fixing and approving of processes and standards previously discussed and recommended by *compulsory* meetings of the analysts, and the ordering or not of prosecutions. Given that in Great Britain, we should then have an excellent law providing protection to the traders against overstrained prosecutions, and to the analysts against charges of incompetency arising through mere differences of opinion.

Sonnenschein.—The death is announced at Berlin of the well-known chemist, Professor Sonnenschein. He had only reached the age of sixty-two.

MILK PRESERVATIVES.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 30th April, 1879.

The trade in milk preservatives appears to have increased of late, the larger number of quack nostrums in use, and the greater extent to which they are advertised, tending to prove that this is the case; but the most convincing proof is to be found in the fact, that the relative proportions of ash and solids not fat in commercial samples of milk sold in London are not so uniform as has been found to be the case in genuine milk, or even so uniform as used to be the case with ordinary samples of milk, whether genuine or watered, as purchased by inspectors. There is therefore a strong inference that as the ash shows a relative increase, mineral matter of some kind has in many cases been purposely added. It is of course highly improbable that this would be added simply for the purpose of increasing either the specific gravity, or the amount of solids not fat; the proportion which could be added for such a purpose would not be sufficient to effect the object sought, and the mineral substances used must be added either as preservatives, or as antiseptics, or must be contained in the form of mineral impurities in common annatto, or some other colouring matter which has been added to the milk.

I have recently examined a few of these colouring matters and preservative fluids, so-called, in order to see what is being used at the present time for the purpose of mixing with milk, and I append a few notes on the results of the analyses.

———'s Extract of Annatto is a very dark-coloured liquid, quite free from suspended matter, sp. gr. 1040. It contains—

Volatile organic matter	2·79 per cent.
Ash (mineral matter)	3·95 ,,
Total solid matter	6·74 ,,

The Ash contained Fe, Na, K, Ca, Al, SO_3, CO_2, with a trace of NH_3.

This liquid is sold at 2s. 9d. per pint, and it is evident therefore that it could not pay to use it for the mere purpose of increasing the "solids not fat" in watered milk, while it is equally possible that the large amount of ash may sensibly alter the ratio between solids not fat and ash in a sample of milk to which it has been added for other purposes. Obviously the only use which could be make of it by a dairyman is to give a higher colour to milk, butter and cheese.

———'s Cake Annatto at 4s. 6d. per lb. contains—

Moisture..	51·2 per cent.
Volatile organic matter	25·3 ,,
Ash (mineral matter)..	23·4 ,,

A qualitative examination of the ash showed Fe, Na, K, Ca, Mg, SO_3, PO_5, Cl, CO_2.

It will be seen that the relative proportions of ash and volatile organic matter do not materially differ from the Extract of Annatto last referred to, and the results of the qualitative examination are sufficiently similar to render it highly probable that the Cake has been prepared from Extract of Annatto of this class by merely evaporating it to dryness so as to render it more portable. It is clear that this Cake Annatto is a far cheaper material to use for colouring, inasmuch as at 4s. 6d. per pound it possesses about four times the relative colouring power—value for value—that the Extract does. There can, I think, be little question that it has been mixed with foreign mineral matters, and these of course may seriously affect the ash of milk with which it has been used; it could not, however, be profitably used to increase the amount of total solids, or to diminish the apparent amount of water in milk.

———'s Cream Sweetener is a liquid sold in canisters at 2s. 9d. per pint, and 16s. per gallon. The instructions issued by the manufacturers state that it is to be added in the proportion of one pint to sixteen imperial gallons, or in very hot or thundery weather it is advisable to use a quart to the sixteen gallons. It is expressly stated that it is perfectly free from adulteration, and that it "assists greatly in throwing up the cream, and even increases the percentage." An examination of the fluid shows that it has a sp. gr. of 1070.

Total solids	12.5 per cent.
Ash (mineral matter)	4·1 „

The most noticeable feature is that the Sweetener contains a large proportion of glucose; the ash consists almost entirely of borax and carbonate of soda. Traces of iron are present, but there is no salicylic acid.

It will be seen that in this case the sp. gr. might sometimes cause a sample of milk to give slightly erratic results, and the addition of glucose to milk or sugar is certainly, in my opinion, a fraudulent admixture. But however this may be, it seems scarcely feasible that any dairyman could use such a compound as this, at the advertised price, for the mere purpose of strengthening watered milk. Even if there were the inclination on the part of any dairyman to adulterate in this way, no profit could possibly ensue to him, but only to the makers of such a nostrum.

———'s Pure Antiseptic Powder fully justifies its name, or at any rate the first adjective, for it consists of pure boracic acid; the retail value of boracic acid is about 8d. per lb., and one cannot help pitying the poor milkman who buys this patent medicine at the rate of 1s. per 6-oz. packet. The directions for use are very interesting: 6 oz. is to be dissolved in a gallon of warm water, and each can is to have from ½ to 1 gill (according to the weather) of the solution to every gallon of milk it contains, and is then to be set aside for the cream to rise. Clearly the makers of this powder are under the impression that dairymen generally want to prepare skimmed milk, instead of to sell the genuine article, as under the Act they are bound to do.

———'s Food Preserver has one merit, or perhaps I should say the proprietors have the merit of being candid, for they coolly say in their advertisement that "if those using it do not object to risk a prosecution under the Adulteration Act, it may be diluted with advantage, as its solution, at the rate of an ounce in a quart of boiling water will give a fluid," &c. This seems to me to be about as clear instructions for adulteration as any I have recently met with. However, this Food Preserver, which is described as a harmless, odourless, colourless, and tasteless powder, and which is sold at the rate of 6d. per ounce packet, or 5s. per pound tin, consists simply and solely of borax. From a list before me I find that the price of borax is about 6d. per pound. I cannot wonder, therefore, that the proprietors find it profitable not only to manufacture, but to advertise such a preparation.

There is another advertisement going the round of the dairy papers of another compound said to have been of immense value in preserving milk, and which the vendors say may be safely used, because it has been certified by medical authorities. This also consists simply of borax.

In conclusion I think Public Analysts would do well to carefully examine the ash of milk for the purpose of detecting borax, or any of these other substances, and then use their judgment as to what future steps should be taken. I think I need hardly say what course I should myself pursue.

SALE OF FOOD AND DRUGS ACT (1875) AMENDMENT BILL.

This Bill was considered by the Select Committee on the 22nd April. The members present were—Mr. Sclater-Booth, chairman; Mr. Anderson, Viscount Barrington, Mr. Chamberlain, Mr. Isaac, Sir G. Montgomery, Mr. C. S. Read, Mr. P. A. Taylor, and Mr. Whitwell.

The two principal sections of the Bill are—

"In any prosecution under Section 6 of the Sale of Food and Drugs Act, 1875, for selling to the prejudice of the purchaser any article of food, or any drug, which is not of the nature, substance, and quality of the article demanded by such purchaser, it shall be no defence to any such prosecution to allege that the purchaser, having bought only for analysis, was not prejudiced by such sale;" and

"In determining whether an offence has been committed under Section 6 of the said Act by selling to the prejudice of the purchaser, spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit to any greater degree than 25 per cent. under proof for brandy, whisky, or rum, or 30 per cent. under proof for gin."

Mr. H. P. Thomas, from the Local Government Board, was first examined, and said he had charge of the Sanitary Department. The reports of all Public Analysts passed through his hands, and he found that 3052 was the total number of samples of spirits examined under the Act during the years 1877-78. The number of samples submitted to Public Analysts in 1878 had decreased in consequence of the decisions with regard to the words "prejudice of the purchaser." In all the cases, with a few exceptions, the adulteration was with water. The old system of adding oil of vitriol and capsicum to make diluted spirits pass for strong liquor had almost entirely disappeared. Public Analysts differed very much as to what quantity of water constituted adulteration. Proof spirit was about half alcohol and half water: 49·24 per cent. of alcohol, and 50·76 of water.

Mr. Bell, the principal of the Somerset House Laboratory, suggested that 35° under proof should be the standard for gin instead of 30° under proof, as the Bill proposed. Fusel oil in whisky was an impurity, but he would not describe it as an adulterant. The 25 per cent. under proof which was proposed to be allowed with regard to brandy was quite enough to cover the cases designated "fine old brandy." Where the spirit was kept in the wood for a very long period a label should be used to indicate the diminution of strength.

Replying to a question, Mr. Bell said that in many analytical cases it would take seven or ten days at least to pronounce an opinion.

The room was then cleared, and the Committee, when the public were again admitted, stated that it was not their intention to call any further evidence.

THE ADULTERATION OF FOOD IN CANADA.

The Official Report on the Adulteration of Food in Canada, forming the Third Supplement to the Report of the Department of Inland Revenue of that province for the year 1878, is, as it was last year, an extremely complete and carefully compiled blue book, which—although only 813 samples were analysed; this, however, being a fair proportion to the population—amounts to nearly 70 pages. The summary shows that adulteration is decreasing in Canada under the influence of the Adulteration Act in exactly the same way as we have found it decrease in England, under the administration of the Sale of Food Act. During 1877 a fraction over 50 per cent. of the samples were found adulterated, while during 1878 the percentage fell to 33·3, or exactly one third of the total number examined. There is one peculiar feature in the table, which might well be copied in the summary of the English reports, viz., a column is devoted to articles not returned as adulterated, but their composition is stated by the Analysts, and this shows that they are of doubtful purity. It is very desirable indeed that some such method should be adopted here, so as to enable Analysts to specifically mark cases where the inference is against the purity of the sample, although the evidence may not be sufficient to justify a distinctly adverse report.

Looking through the summary it appears that condiments and flavouring materials are very largely adulterated, the Report itself stating not with things injurious to health, but with things of inferior value; for instance, we find that 91 per cent. of the samples of allspice were adulterated, and 75 per cent. of the samples of coffee. Out of 80 samples of butter examined, 12—*i.e.*, 15 per cent.—were found to be adulterated, and the Report states that the adulterated samples were, with one exception, found in the possession of market people or small dealers. Canned fruit was found to be adulterated in the proportion of one out of every five, and milk was found to be adulterated in 40 per cent. of the samples. In some cases this adulteration was simply deficiency of fat, but in a considerable number of cases it was water.

The Analysts have been directing special attention to the adulteration of sugar, and especially to the proportions of glucose found to be present in it; this glucose amounted in one case to as much as 14 per cent. We quite agree that it may be necessary to fix a legal limit above which the presence of glucose should be held to be fraudulent; but judging from the character of the sugars of low quality put on to this market it does not appear to us at all probable that glucose had been purposely added in any of the cases referred to. It seems far more likely that a similar, although not identical fraud had been carried out by boiling the sugar in such a way as to produce a considerable proportion of glucose in it, so as to change its grain for the purpose of enabling a much larger drawback to be obtained from the Government when the sugar was exported. It is scarcely a feasible thing to mix glucose directly with sugar; but it is very easy to manufacture glucose in large quantities while the sugar is being concentrated in the pans.

The Report itself is a model of the manner in which adulteration returns should be published by the Government, every sample being separately reported on with the details of the adulteration found, and the whole are tabulated in a convenient form for reference. If our Local Government Board could see their way to tabulate the 50,000 analyses which have been made by the English Analysts during the last four years, the result would be a collection of information which would be of inestimable value to Analysts and tradesmen in future.

In conclusion, we need do no more than point out that, in reference to milk, every sample analysed by Messrs. Ellis, Edwards, La Rue, and Fraser, has been reported in a tabulated form so as to show the amount of fat, caseine, sugar, ash, and in nearly every case the percentage of water added.

SEPARATION OF QUININE AND STRYCHNINE.

By B. W. Dwars.[*]

When small amounts of strychnine must be estimated in presence of much quinine, it is advisable, according to the author, to remove first the bulk of the quinine, and this is most effectually done by means of ammonium oxalate, quinine oxalate being almost insoluble in excess of that re-agent. The author used the following process for the analysis of a sample of the well-known Citrate of Iron with Quinine and Strychnia, which, as his analysis shows, is not always what it ought to be.

Five grms. were dissolved in a little water, super-saturated with ammonia, and shaken with chloroform. After evaporating the chloroform, and drying the residue at 110° C., there remained ·81 grm. =16·2 per cent. alkaloids. These were now dissolved in 10 c.c. warm water, and a few drops sulph. acid, then neutralized by ammonia and mixed with ammonium oxalate in excess.

After standing for twenty-four hours the quinine oxalate was collected on a weighed filter, the mother liquor still adhering to it removed by gentle pressure, and finally *once* washed with water. After drying at 100° C. it weighed ·704 grms., or ·618 quinine.

The filtrate and wash water were shaken up with ammonia and chloroform, and the latter yielded on evaporation ·1775 grms., consisting of amorphous alkaloid (which ought not to exist in the pure drug), strychnine, and traces only of crystallizable quinine. It was twice treated with 3 c.c. of pure ether, which dissolved the amorphous alkaloid, and left behind ·021 grms. of pure strychnine. Only minute traces of strychnine were lost. The final result was as follows:—

Cryst. quinine ..	..	12·36	per cent.	= quinine citrate	..	17·66 per cent.
Amorphous quinine	..	3·13	,,	= ,, ,,	..	4·44
Strychnine ,,	..	·42	,,			——
		——				22·10
		15·91				
Loss ..	..	·29				

So 22·10 per cent. quinine citrate instead of 24 per cent.; and ·42 per cent. strychnine instead of 1 per cent.

Duties of Analysts.—At the meeting of the Holborn District Board of Works, on April 2, Mr. Walker called the attention of the Board to the fact that during the past three months there had been no complaints whatever in regard to adulterations in the district. He suggested that, instead of paying their Analyst by salary, the Board should give a fee per case. Mr. Mather said they had certainly had no "flaming sensational cases" recently, but at the same time their Analyst had not been idle, as would be seen by the number of samples that had been investigated. He thought it a matter of congratulation that the inhabitants were apparently being supplied with good and wholesome goods. The subject then dropped. Mr. Walker seems to consider that prosecution of the trader rather than protection of the public is the aim of the Sale of Food and Drugs Act.—*Chemist and Druggist.*

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[*] *Pharmaceutish Weekblad, Jaargang 15th, No. 46.*

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—As I was not present on the 15th January last, when the discussion took place on my note on the "Influence of Age on the Composition of Butter Fat," I shall be glad to reply by a letter in your columns, more especially as the criticisms were very far from flattering.

Dr. Dupré says it was "unfortunate" I had published two analyses of some of the butters; now I think some of your readers who may have read my three contributions on the subject may not be of the same opinion, and I will try to show why I claim exemption from deserving Dr. Dupré's severe strictures. I think it must be admitted that I clearly show how the figures forming the tables in my first paper were arrived at, the amount of washing, &c., &c., and this paper raised perhaps only two original questions: 1st. Are not the "Insoluble Acids" generally somewhat higher than stated by Dr. Dupré? 2ndly. Did volatility in the air-bath account for the lower results? At any rate, these were the only two points questioned in the discussion, and I most willingly admit that both, *i.e.*, my higher "insoluble acids" and observed volatility were suggested as being accounted for by the extent of the washing; this I doubted at the time, and hence the experiments communicated in my second note, which went against my opinion, and proved the conjectures of my friends correct. Now, it is certainly more gratifying to find one's opinion confirmed, yet I cannot recognise any "great moral courage" in admitting and showing its confutation; but, observe, I simply admit an error of *opinion* as to the *action of further washing*. I by no means accept the extended washing as desirable, leading as it does to an extra loss in the analysis; only about a third of the bodies so extracted being estimated with soda on the factor in use, and my opinion is still what I expressed at the end of my second note, that I consider the analyses in my first paper show the more correct constitution of butter fat than if the washing be extended. The term "insoluble" can only be applied here in a comparative sense to indicate practical insolubility in water: for continual washing will produce continual diminition to some degree. Washing beyond the extent mentioned in my first paper, which gives a total filtrate of about 600 c.c., extracts only about 5 milligrammes per 100 c.c. I therefore think such extended washing is not worth pursuing, especially as it is mainly lost in the analysis by being reckoned on the factor for butyric acid.

The results shown in my third paper of the analyses of the butter fat, after keeping the butters, I say are strictly comparable with the first analyses, being, as there stated, conducted in exactly the same way with the same washing. How then is the table thrown out and made useless, as stated by Dr. Dupré? The exact *modus operandi* is known, the amount of washing is stated, and the effect of extended washing, if any one prefers to pursue it, can be calculated from the second paper.

I have not and do not admit the "insoluble acids" in my first paper to be incorrect, and cannot see Dr. Dupré's authority for stating it.

Respecting the results in my third paper, I will only say that there is no mistake about the irregularity of the character of the changes either as to specific gravity or constitution of the fat as to soluble and insoluble acids.

Yours truly,

E. W. T. JONES.

Wolverhampton, *March 26th, 1879.*

To the Editor of "The Analyst."

Sir,—The following notes on the permanganate process of Professor Tidy may be welcome to some of your readers:—

A permanganate solution was prepared in accordance with his directions on the 3rd of last March; a large clean crystal of hyposulphite was selected, powdered, dried in blotting paper, and the necessary quantity weighed off for the standard solution; 54 septems were required to destroy the blue colour of the iodine in the experiment conducted at the commencement of the three hours; exactly the same quantity was requisite after one hour, and after three hours. The flasks were in moderate daylight. Repeated experiments have since shown, that under these circumstances, no change whatever takes place in the weak acidified solution of permanganate in distilled water during the period required for one of Tidy's determinations.

On the 20th of March the same solution of permanganate was titrated for another purpose, with freshly prepared decinormal oxalic acid; ten grain measures, very carefully taken, required 8·2 c.c. of permanganate.

On the 28th of March the solution was again titrated with "hypo." selected, powdered, and dried as before; 53 septems of hypo. solution were required.

On the 10th of April (this morning) the solution was again examined as before, with both "hypo." and decinormal oxalic acid; 53 septems of hypo. solution were required for the 20 septems taken as usual, and ten grain measures of the oxalic acid were oxidized by 8·3 c.c. The "hypo." was in each case taken from the same batch.

It would appear, therefore, that a solution of permanganate of Tidy's strength can be depended upon for at least a month, at the average temperature of a laboratory in the spring (from 40° to 55° F.). It should be mentioned that the solution which forms the subject of this letter was jealously excluded from the light, and I am of opinion that the commonly accepted idea of the extreme instability of weak permanganate solutions is to be traced to a neglect of this precaution.

Since the appearance of Professor Tidy's paper I have been in the habit of working water analyses in duplicate, by his process and that of Wanklyn, and the impression left on my mind by the limited experience I have had at present is, that, if the latter process be carried out exactly in accordance with the directions of its author, the agreement in the conclusions to be drawn from the results of the two methods will be much closer than it was found to be by Tidy, when working with his considerably modified form of the ammonia process. Yours, &c.,

Shrewsbury, *April 10th, 1879.* THOS. P. BLUNT, M.A., OXON., F.C.S.

TO THE EDITOR OF "THE ANALYST."

SIR,—We observe in THE ANALYST for this month, there is a report of a paper read by Dr. Dupré, before the Society of Public Analysts, upon violet powder, in which the "Steamer Over a Globe" Violet Powder is prominently mentioned.

Passing over the fallacies and the erroneous conclusions[*] contained in the paper, and the questionable proceeding of actually enumerating arsenic, amongst the constituents of different varieties of violet powder, in estimating their respective merits; to prevent any misunderstanding, we wish to state distinctly as a fact, that the solitary conviction at Lambeth, for selling violet powder, which appears to be Dr. Dupré's only crumb of comfort on this question, did not refer to our "Steamer Over a Globe" Violet Powder, or it would have been immediately appealed against; but, that when that invincible article was brought before the same magistrate, on April 2nd last, after hearing evidence on both sides, Mr. Chance pronounced this Violet Powder uninjurious, that there was no official formula for violet powder, hence it could not be said to be adulterated; he dismissed the summons, and also another against a different maker, thus virtually cancelling his former adverse decision, and leaving the article practically victorious in every case.

We enclose our card, and remain yours, &c.,

THE MANUFACTURERS OF THE "STEAMER OVER A GLOBE" VIOLET POWDER.

[*] The writers omit to point out what are the fallacies and erroneous conclusions to which they allude. —ED. ANALYST.]

ANALYSTS' REPORTS.

Mr. J. Baynes, Public Analyst for the East Riding of Yorkshire, reports that during the March quarter he examined forty-three samples, of which fourteen were adulterated, viz.: 1 of bread containing 28 grains of alum per 4lb. loaf, but as to which no conviction was obtained owing to the Somerset House Authorities; 1 of butter containing 20 per cent. of foreign fat; 4 of coffee containing from 16 to 40 per cent. of chicory; 5 of mustard containing from 5 to 60 of farina; and 3 of sweet spirits of nitre adulterated with from 26 to 50 per cent. of water.

Mr. Baynes also reports that, as Analyst for Scarborough, he examined nine samples during the past quarter, viz.: 1 of water; 2 of bread; 1 of gin adulterated with 24·8 per cent. of water; 1 of whisky adulterated with 38 per cent. of water; and 4 of milk, all of which were pure.

Mr. Baynes also reports that, as Analyst for Kingston-upon-Hull, he examined three samples of water, and five samples of milk, which latter were not submitted under the Act, but owing to the cattle disease being prevalent. All the samples were uncontaminated.

Mr. J. Carter Bell, Public Analyst for Salford, reports that during the past quarter he examined 135 samples, and he found twenty-three adulterated, consisting of 9 samples of milk, 4 of bread, 2 of coffee, and 8 of sweet spirits of nitre. He congratulated the health committee upon the marked improvement in the articles sold in the borough. "Some time since," the report continues, "it was common to find bread containing 20, 30, and 40 grains of alum to the 4lb. loaf, a quantity, I believe, sufficient in many cases to be seriously detrimental to health; whilst now the adulterations are few and far between. Out of the many samples of bread and flour taken, only 4 were adulterated, and that in but a small proportion. Out of 220 samples of milk taken since March, 1878, I found 164 pure, 28 nearly so, and in only 28 cases was there such a departure from the standard as to justify a prosecution." In a special report of analyses which he had conducted to ascertain the adulteration of flour and bread with alum, Mr. Bell states that owing to the energetic manner in which the health committee had carried out the Adulteration Act, and particularly through having caused these investigations to be made, the adulteration of bread and milk in Salford has sunk almost to a minimum.

Mr. J. Carter Bell, Analyst for Cheshire, in his report for the quarter ended 31st March, states that he had examined 178 samples. Of these, 66 were adulterated, namely, 20 of gin, 13 of whisky, 7 of milk, 15 of coffee, 9 of sweet spirits of nitre, and 2 of annatto. Many samples of beer had been analysed during the past six months, and he had examined many of them for cocculus indicus, grains of paradise, tobacco, sulphate of iron, alum, and other noxious ingredients. In some cases such a lengthy examination could not be made, because the quantity of beer sent was too small to permit of a searching investigation.

Dr. Emmerson, Public Analyst for Leicestershire, reports that during the past quarter forty-two samples were submitted to him under the Act, viz: 14 of arrowroot, varying very much in quality, but all genuine; 14 of coffee, three of which were mixed with chicory; 14 of tea (10 green and 4 mixed)—with the exception of some samples, which were faced to improve the appearance of the teas, they were all genuine and pure. All teas being now examined by the Customs' authorities, and as tampering with the teas does not take place in this country, it is very rare now to meet with adulteration. The various samples of food, &c., which he had analysed had steadily improved in purity, and he had no doubt that the periodical visits of the inspectors, and the proceedings instituted under the Act, had proved a protection to the public against adulteration.

Mr. A. H. Allen, Public Analyst for Sheffield, in his quarterly report states that he has examined four specimens of compound tincture of camphor, an official preparation which is largely used by both the medical profession and the public, and which is closely related to the popular remedy known as "paregoric." Three of the samples turned out to be perfectly satisfactory preparations, and with respect to the fourth he found it deficient in alcohol, oil of anise, and benzoic acid, but it contained a proper proportion of opium, and he could express no decided opinion as to the proportion of camphor. The absence or omission of the oil of anise and benzoic acid was in a great measure a consequence of the preparation being made with alcohol deficient in strength. The value of them, in the proportion used, is too slight to be an important consideration. Although the benzoic acid and anise oil have a certain medicinal value and are not added to the tincture without a definite object, the chief remedial agent is the opium, which in the sample in question was present in proper amount. During the past quarter he had also had his attention called to a particular "teething and fever powder," which is stated to have produced very violent effects on more than one child to whom it was administered. On examination a sample proved to contain mercury and antimony in medicinal doses. Although the incautious administration of such a remedy might prove dangerous, it appeared that there was no power of dealing with the matter under the Sale of Food and Drugs Act, as the powders were intended to produce certain medicinal effects, and the inspectors got what they asked for, namely teething powders.

Analysts in Dorsetshire.—Mr. Comyns Leach, Public Analyst for Dorset, has just been appointed to the same office for the borough of Weymouth at a salary of £10 per annum, and fees. Mr. George, of Dorchester, was originally an applicant for the office, but withdrew his application. Mr. Jones, Mr. Brierly, Mr. H. L. Hobbs, Mr. A. R. Wilson, Mr. C. E. Cassell, and Mr. A. Angel also applied—all, with the exception of Mr. Brierly, offering their services at ten guineas per annum, a fee of 10s. 6d. for food analyses, and a fee of a guinea for water analyses. Mr. Brierley asked £40 per annum. Dorchester borough has not yet made its appointment, and in several other boroughs in Dorset the matter is yet in abeyance.

An Innocent Man found Guilty.—*The Grocer* reports that Mr. Frederick George Innocent was found guilty, and fined 10s. for selling adulterated coffee. We suppose it must be correct since the trade journal announces it.

LAW REPORTS.

Tincture of Camphor.—Robert Bennett, chemist, King-street, Sheffield, was summoned under the 7th Section of the Sale of Food of Drugs Act, 1875, for selling a compound article or drug not composed of the ingredients in accordance with the demands of the purchaser. The Town Clerk (Mr. J. Yeomans) appeared to prosecute. Inspector Brammer, in February last, purchased from the defendant eight ounces of compound tincture of camphor, for which he paid 1s. 5d. He afterwards submitted a portion of it to Mr. A. H. Allen, the Borough Analyst. Mr. Allen's report was to the effect that his analysis showed that the compound contained 34 per cent. of alcohol, instead of 48 per cent. It also contained a mere trace of benzoic acid, and only a trace of oil of aniseed. Dr. Hime, Medical Officer of Health, said that the absence of the proper proportion of ingredients would prevent the article from having the effect it should have. Mr. Bennett said he was prepared to swear that the whole of the ingredients as required by the Pharmacopœia were in the compound in their proper proportions, with the exception of the spirit. The farriers required a weaker sort of spirit, and by mistake that spirit had been got hold of. He had been in business all his life, and this was the first time he had infringed the Act. A fine of £5 and costs was imposed.

Adulterated Coffee.—At the Derby Borough Police-court, lately, Mr. Frederick George Innocent was summoned on the complaint of Mr. Clarke, inspector under the Act, for selling to him a quarter of a pound of what purported to be coffee, but which was not of the nature and substance of coffee. Mr. Clarke went to the defendant's grocery and provision shop in Depôt Street, and purchased a quarter of a pound of coffee for 4d. He then told the defendant that he was the inspector under the Food and Drugs Act for this borough, and had bought the coffee for examination by the Public Analyst. Defendant said—"All right; I know my coffee is all right. I buy it all right." Witness divided the coffee into three parts, which he sealed, and handed one part to the defendant, kept one himself (which he now produced), and handed the third to Dr. Goode, the Public Analyst. On March 28th he received a certificate from Dr. Goode, which stated that the coffee was mixed with 50 per cent. of chicory. Defendant said he was not at home often, and the shop was left almost entirely to his wife. The Chairman: But you are responsible, and you served the officer with the coffee—at least, with coffee and chicory, when he asked for coffee. The bench fined the defendant 10s. and costs, including the Analyst's fee of £1 1s. They also expressed their satisfaction that these cases of adulteration were being taken up, as poor people were those who suffered most by them.

Adulterated Chocolate.—At the Teignmouth Police-court, J. W. Sowton, grocer, of Newton Abbot and Shaldon, appeared in answer to an adjourned summons, in which he was charged by Supt. Moore with having sold an article of food represented to be chocolate, but which was not of the nature and substance of chocolate, being adulterated with a mixture of coffee, arrowroot, and sugar. Supt. Moore stated that he went to the defendant's shop at Shaldon, and asked the assistant if he had any cocoa except that in packages. The assistant said he had not, and witness then asked if he had any chocolate. The assistant replied that he had, and witness asked to see it. The assistant then took some out of a tin canister on the counter, labelled "Chocolate," and showed it to him. Witness asked if it was pure chocolate, and the assistant said it was, and that they sold a good deal of it. Witness then asked for six ounces, which the assistant weighed up. It was first put up in one parcel; but afterwards, at witness's request, it was made up into three parcels of two ounces each, one of which he handed back to the assistant, and another he kept, whilst the third, fastened and sealed, he sent to Dr. Blyth, Barnstaple, the County Analyst. A few days afterwards he received Dr. Blyth's certificate of the analysis, as follows:—"I am of opinion that the sample is a sample of adulterated cocoa. The sample is not chocolate at all, and should not be sold as such. It is a mixture of cocoa, arrowroot and sugar. The per-centage of cocoa does not exceed 45·0 per cent." Supt. Moore said he paid 2½d. for the packets, and he proceeded to state that since the last hearing he had again written to Dr. Blyth, on the subject of chocolate, and he (Dr. Blyth) had replied as follows:—"I am not aware of the existence of any substance in commerce sold under the name of 'chocolate powder.' Chocolate itself is a paste, which is manufactured by grinding cocoa nibs in a mill, the rollers of which are heated by steam to soften the cocoa butter. The paste is afterwards mixed with refined sugar and a few flavouring matters, such as vanilla, almonds, cinnamon, cloves, &c. No arrowroot is used. On the other hand, cocoa is either sold in the form of nibs, which is simply the roasted seed deprived of its covering, or as flake cocoa, which is the seeds ground in a particular way. Lastly, the various mixed cocoas of commerce are incorporated with sugar, arrowroot, &c., and sold under various names, such as Soluble Cocoa, Homœopathic Cocoa, Epps's Cocoa, &c. Such are now almost invariably sold in packets, stating on a label that the article is a mixture. If a person asks for chocolate, he expects to get the paste as above described, with certainly no admixture of arrowroot; if he asks for cocoa, then cocoa pure and simple must be given, unless it is definitely stated by label or otherwise that the article is mixed." Defendant here produced a large tin canister, labelled "Taylor Brothers' Chocolate Powder," and Supt. Moore admitted that he was supplied from the tin, or one of that kind. He added that he was not aware there was any difference between chocolate and chocolate powder. He asked for chocolate and he believed he had got what he asked for. In cross-examination Supt. Moore said he did not know there was such an article as Chocolate Menier, but he had heard of chocolate creams. He was positive that when the assistant took out some of the contents of the tin he did not say it was chocolate powder. The chairman asked the witness if he expected to get the article he asked for in powder or in substance. Supt. Moore replied that he did not know in which form he should receive it. Defendant thereupon took the objection that the article had not been sold "to the prejudice" of Supt. Moore, because he did not know what he wanted to buy. Supt. Moore admitted that he did not know there was such a thing as chocolate powder. Defendant said there was no such thing as pure chocolate; it was a manufactured article. Some was sold at 6½d. per lb. to meet the wants of the poorer classes, whilst Chocolate Menier and chocolate cake, being of a superior quality, were sold at 1s. 8d. per lb. John Peake, manager of defendant's branch shop at Shaldon, said when Supt. Moore asked him for chocolate he replied that he had chocolate powder. He then showed Supt. Moore part of the contents of the tin produced, told him it contained chocolate powder, and called his attention to the label on the tin to that effect. Defendant said as a matter of fact in the grocery trade there were many sorts of chocolate. It did not grow, like coffee, but was an admixture: there was no standard for chocolate, and never had been. In Nuttall's dictionary chocolate was defined as "an alimentary paste or cake, composed of the kernels of cocoa-nuts, roasted, ground, and mixed with other ingredients;" and in Royle's "Manual of Materia Medica" it was stated, "Chocolate is an artificial compound, prepared with cocoa, sugar, starch, vanilla, cinnamon, &c." Since the last hearing he had written to two of the principal houses in the country on the subject. Messrs. Cadbury Brothers, cocoa and chocolate manufacturers, of Birmingham, wrote, "The word chocolate implies a mixture of cocoa with other ingredients, and is understood as such when it passes the Customs, whereas the genuine article always passes through the Customs as 'cocoa.' We, therefore, never call anything cocoa unless it is a perfectly genuine article." Messrs. Taylor Brothers, cocoa and chocolate manufacturers, of London, wrote, "In selling chocolate it is not necessary to declare or affix a label; the word 'chocolate' itself, meaning an admixture, is sufficient." Being an admixture of a manufactured article, there could, defendant maintained, be no adulteration; and the price of the article asked for was a guide as to the quality required. The chairman said it was a very difficult point for the bench to decide upon. It was stated that chocolate was asked for, and that the article supplied was sold as chocolate, whereas the County Analyst said it was simply not chocolate at all. Defendant remarked that Dr. Blyth had made a standard for himself. The chairman went on to say that, as there was no such thing as chocolate, it was immaterial whether the superintendent was supplied with chocolate or chocolate powder; and as there was such difficulty in laying down what chocolate actually was, the bench had no other course to pursue than to dismiss the summons. It was not proved to them—in fact it was proved to the contrary—that there was any such thing as real chocolate, although it was included in the list of articles of food for Supt. Moore to examine to find if they were adulterated. Defendant said if the bench had decided the case against him he should have carried it to a higher court, as the matter was an important one to the grocery trade. The chairman admitted that it raised a very important point, and said he did not think they could have settled it in any other way than they had.

ALUM IN BREAD.—Thomas Smith, baker and flour dealer, Pendleton, appeared at the Police-court, in answer to a summons which charged him with having sold adulterated bread. Mr. Walker, assistant to the Town Clerk, prosecuted, and Mr. Bennet defended. Mr. C. Thompstone, the inspector under the Act, stated that he visited the defendant's shop on the 25th March and bought samples of bread and flour. While making the purchase the defendant came in and began to speak about dealing with a respectable firm for flour, and remarked to witness that "if anything there would be something in the Austrian flour." Mr. J. C. Bell, the Borough Analyst, said he had made analyses of the bread and flour submitted to him by the last witness. He found the bread to contain alum to the amount of 16 grains to the four-pound loaf. The flour he found to be perfectly pure. In answer to Mr. Bennet, the witness said he was not aware that it was easier to knead the dough when alum was mixed with the flour. When the flour had become bad alum made it work up easier. Mr. Bennet, on behalf of his client, pleaded that though it was true the bread was baked on the defendant's premises, Mr. Smith never entered the bakehouse, and did not see the workmen. He could not, therefore, have committed the offence for his own benefit. It was certainly easier to work up flour, and there was no doubt the men in the bakehouse had put alum in the flour to save them trouble. He thought the magistrates would come to the conclusion that though the defendant was liable to a fine the defendant's was not a bad case. Mr. Bennet called two of the defendant's employés to prove that the defendant was not in the habit of visiting his bakehouse. Mr. Makinson said in his opinion that was a bad case. A good deal of alum had evidently been put in the flour. The defendant would pay a fine of £10 and costs. It was stated to the magistrate shortly afterwards that the defendant refused to pay the fine. The defendant came before the court and gave as a reason for not paying the fine that he wanted to ask the Analyst a question and had not been allowed. Mr. Makinson informed the defendant that when he had counsel to defend him he (the defendant) could not address the Court and ask questions as well. The defendant said he had only seen Mr. Bennet that morning. Mr. Makinson said he should have done so earlier; that was his own fault. He made an order for distraint upon the defendant's goods in payment of the fine should he still refuse, and in default of having goods to distrain upon the defendant would have fourteen days' imprisonment. The defendant said he would pay the fine.

NOTES OF THE MONTH.

A very interesting case to Analysts has taken place since our last. A brewer in Donnington has been charged with adding sugar to his malt wort without possessing a licence to do so. It is always unsatisfactory to discuss a case of disputed analysis on the ordinary printed reports which are seldom perfectly accurate, but the following is an abstract of the proceedings as detailed in the newspaper before us. It seems that the officers entered the premises on the 26th November last, and found a brewing commenced before the specified time. They accordingly took samples of the wort, and sent the same to Somerset House, where the analysis was commenced by a Mr. Burge, one of the assistants, early on the 27th. The grains having been gauged by the officer, were found to correspond with the quantity of malt entered as used, and no sugar was found upon the premises, so that the whole case hinged upon Mr. Burge's analysis. He found the density to be 1092, and 12·72 per cent. of "sugar natural to malt" with 3·43 of cane sugar. The report does not state the process employed, but it appears, from subsequent indications, to have been the usual determination of glucose by "Fehling," and then another determination, after inversion, calculating the excess of copper used to cane sugar. The evidence of Mr. Burge was supported by Messrs. Bannister and Harkness, who had no doubt (from examining his results) as to the presence of cane sugar in the sample, and they further stated that, owing to the rapid conversion of cane sugar into glucose, and glucose into alcohol, such an analysis would be perfectly useless unless commenced within two or three days. They also asserted that, in fact, this very sample in dispute had lost all its sugar on the 5th December, and this is no doubt an important factor in the case. On the other side Mr. Hehner was called, who received the duplicate from the brewer on March 3rd, 1879. It then had a specific gravity of 1088, which he stated, "was a difference as against 1092 not worth speaking of, and my sample was as fresh as if just taken." He did not find a particle of cane sugar in it, although the analysis of the chemists for the prosecution was practically his own. "The majority of modern chemists think that there is no glucose in malt, but maltose, the latter making half as much again as what was called glucose. The malt wort calculated in this way would show no cane sugar." In a subsequent letter to a contemporary, Mr. Hehner further explains his views, which, omitting some rather strong language (always undesirable in a scientific discussion) are *as follows*:

"Upon the composition of genuine malt the case depended. Now a number of years ago it was pointed out by Continental chemists, and more recently was conclusively proved by English investigators, that malt and malt wort does not, as was formerly believed, contain a modification of sugar called glucose, but an altogether different substance, maltose. Numbers of modern chemists have placed this fact beyond dispute. It should have been the plain duty of the Excise chemists, either to alter their exploded notions as to the composition of malt, or they should have at once and publicly disproved their opponents' statements. A middle way seems to me to be impossible.

"But, marvellous to state, in the case against Mr. Kidd they actually ignore altogether the modern researches as to the substance called maltose, upon which the whole case turned; they did not deny its existence; they did not disprove it; they merely shut their eyes and ears, and declared virtually that they did not want to know anything about it.

"If there had really been cane sugar in the malt wort it would have been a comparatively easy matter to get it out of it again in the crystallised state, fit to be produced as incontrovertible evidence in town. They contend that it is impossible to get the cane sugar out of the liquor; but the thing has been done, and I myself am ready to do it."

We have thus shortly placed before our readers the germs of "a very pretty quarrel as it stands," and would, before making remarks ourselves, call attention to the importance of the subject, and ask for any communication our friends may be pleased to send *pro* or *con*, so that so important a matter may be thoroughly ventilated. No doubt the Excise chemists have many practical results on the point, for which we should be glad to find space, if they think fit to send them; and Mr. Hehner will also doubtless be able to give some experiments in support of his views.

While looking over the *Brewers' Guardian*, which, of course, has something to say on the above case, we were struck with the idea, that it is very amusing to notice how the trade journals, who delight in applauding Somerset House when it goes against an analyst, can, at the same time, write against those they flatter, when they in turn decide against a trader. Verily popularity with all is difficult of attainment! Perhaps it is undesirable.

Apropos of the mention of the proposed Adulteration Act for America at the last meeting of the Society, we may state that on February 27th last, a bill to prohibit the dilution of milk was introduced into the United States Legislature. The Act not only proposes to punish dilution, but pronounces "all milk obtained from animals fed on any substance in a state of putrefaction or fermentation to be impure and unwholesome milk within the meaning of the Act." The difficulty will be to obtain evidence of such feeding, otherwise the idea is a very good sanitary precaution.

We have before had occasion to point out the lamentable manner in which the journal of a great corporation like the Pharmaceutical Society is occasionally made the vehicle of venting personal spleen, and ignoring the claims of those privately distasteful to certain parties. This occurred noticably in connection with the organization scheme, and now again it crops up in a most unpatriotic, unjust manner, on the question of butter analysis. When Messrs. Angell and Hehner published their book on butter it was met by the editor of the *Pharmaceutical Journal* with a most cutting review, in which misprints were taken advantage of to detract from its value, and the uselessness of the process and absurdity of the conclusions broadly hinted at. Since then the successive researches of Dupré, Muter, Jones and others, which have culminated in perfecting and reducing to exactness the butter process as now universally employed in England, have been invariably passed over in complete silence by this journal, which professes to keep *au courant* with chemical science. But the moment a foreign chemist happens to plagiarize the process, and write a paper, giving in his own name what is practically the English method of butter analysis, as perfected by the members of our Society and published in THE ANALYST, forthwith the *Pharmaceutical Journal* wakes up to the fact, and the full English process of butter analysis appears—not in the names of its originators and improvers, but in that of a Mr. H. Hager, whose name was never heard of before in connection with butter analysis. Perish the thought of recognising home researches; never mind what occurs at our very doors, so long as we can bring in a foreigner to take the credit in the minds of the members of the Pharmaceutical Society. Surely the readers of the *Pharmaceutical Journal* must have known all that is in Mr. Hager's paper long ago, or else they are sadly behind the times.

Mr. A. Angell has been appointed Public Analyst for Newport, Isle of Wight; also for the Borough of Guildford.

Mr. E. H. Moore has been appointed Public Analyst for Chichester.

Mr. T. H. Walker has been appointed Public Analyst for Carlisle.

Mr. J. Baynes has been appointed Public Analyst for Grimsby.

ON THE WORK DONE BY PUBLIC ANALYSTS UNDER THE SALE OF FOOD AND DRUGS ACT DURING 1878.

A PRINTER'S error occurs in the second paragraph of the paper on this subject, published on page 67 of our last number. The percentage of adulteration during the last few years should be as follows:—

During the time of the Lancet Commission	65·0
" 1872	26·0
" 1875—6	18·1
" 1877	17·7
" 1878	16·58

THE SANITARY FLUID.

THIS is the disinfectant which was adopted by the authorities at Woolwich for use during the recovery of the bodies from the wreck of the *Princess Alice*, and the mere fact that its use under such trying conditions proved satisfactory says something in its favour. In chemical composition it is essentially a solution of an alkaline hypochlorite, with slight excess of alkali. Hence the liberation of chlorine is slow and fairly constant for some time. Two experiments on samples of urine gave satisfactory results, as putrefaction was retarded for several days longer than in similar samples treated with carbolic acid solution.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
3163	J. Schwartz	Manufacture of Sugar	2d.
3252	A. P. Price	Treatment of Saccharine Substances	6d.
3282	A. A. Croll	Manufacture of Sulphate of Alumina	4d.
3315	C. W. Siemens	Apparatus for Electric Lighting	2d.
3341	J. P. Rickman	Manufacture of Ammonia	6d.
3386	R. W. Papineau	Employing Bisulphide of Carbon, for recovering various substances	6d.
3489	J. Wraith and G. A. Downs	Preparing and Dyeing Fabrics	6d.
3518	A. R. Molison	Electrical Apparatus for Igniting Gas	6d.
3701	J. Mactear	Apparatus for obtaining Sulphurous Acid	6d.
3783	H. Gaskell	Manufacture of Alkali	2d.
5016	H. J. Haddan	Treating Ores containing Silver and Copper	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Anti-Adulteration Review; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American *Chemical Society; Le Praticien*; The Inventors' Record; Electric Lighting, by R. P. Spice.

THE ANALYST.

JUNE, 1879.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 30th April, 1879, at Burlington House, Piccadilly, the President, Dr. Muter, M.A., F.C.S., in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. Hehner was appointed Scrutineer to open the voting papers, and reported that Mr. J. Nimmo, Assistant to Mr. Bernard Dyer, of London, and Mr. J. W. Tayler, Assistant to Dr. Baker Edwards, of Montreal, Canada, had been elected as Associates.

Mr. Heisch read a paper by Mr. Allen "On the Analytical Examination of Tinctures."

Mr. Heisch also read a paper by Mr. Wigner "On Milk Preservatives."

And a paper by Mr. F. P. Perkins "On a Microscopical Study from the Bottom of a Claret Cask."

The next Meeting of the Society will be held at Burlington House, on Wednesday, June 4th, at half-past seven o'clock, when the following amongst other papers will be read: "On the Analysis of Spiritus Ætheris Nitrosi," by Dr. Dupré, F.R.S.; "On the Analysis of Flour and Bread," by J. Carter Bell, F.C.S.; "On the Composition of Devonshire Cream," by A. Wynter Blyth, M.R.C.S.

NOTES ON THE ANALYTICAL EXAMINATION OF TINCTURES.

By Alfred H. Allen, F.C.S.

Read before the Society of Public Analysts, on 30th April, 1879.

I have had occasion lately to make some experiments on the "Tinctures" of the British Pharmacopœia, and as some of my experiences are of a rather novel character they appear worth recording.

I may premise that the so-called "tinctures" or "spirits" of pharmacy, are of two distinct alcoholic strengths. "Rectified Spirit, B.P." (sp. gr. ·838 = 84 per cent. by weight of absolute alcohol = 155½ per cent. of proof spirit), is directed to be employed in the preparation of the tinctures and spirits of chloroform, ether, aconite, ferric chloride, ferric acetate, iodine, myrrh, nux vomica, camphor, ginger, &c. On the other hand, "Proof Spirit, B.P." (sp. gr. ·920 = 49 per cent. by weight of absolute alcohol), is directed to be used in making the tinctures of orange-peel, belladonna, cantharides, catechu, digitalis, ergot, opium, rhubarb, squills, &c.

In many instances, the alcohol is the chief element of cost in the preparation of tinctures, and there is consequently a strong inducement to economise it as much as possible. Hence, it is not unusual to find proof spirit substituted for rectified spirit, and a mixture of equal measures of rectified spirit and water for proof spirit. Of course, alcohol so deficient in strength is apt not to dissolve the active constituents of the drugs employed.

On the other hand, some of the leading firms prepare their tinctures with alcohol of 60° O.P., and yet use it in the same proportion as if it were merely 55° O.P., as required by the Pharmacopœia.

In many of the official tinctures, the determination of the alcohol presents no difficulty. Mere distillation will suffice to separate it in a state of approximate purity from the tinctures of aconite, arnica, belladonna, calumba, capsicum, catechu, jalap, nux vomica, opium, quinia, &c.; and the same is true of the tinctures of iodine, ferric acetate, &c., if they be first rendered distinctly alkaline with caustic soda. On the other hand, the tinctures of benzoin, myrrh, ginger, camphor, rhubarb, &c., give a distillate contaminated with essential oils or similar volatile matters in quantity sufficient to affect, more or less seriously, the determination of alcohol by the density. The same is true of the "aromatic spirit of ammonia," and tinctures prepared with it, with the additional objection that the distillate will contain ammonia, unless the alkaline reaction of the spirit be previously carefully neutralized by hydrochloric acid.

If any of the tinctures to which the distillation process is not directly applicable be diluted considerably with water, the essential oil is precipitated more or less completely, but usually in so fine a state of division that filtration is completely useless. I find, however, that this difficulty may be got over very simply by operating in the following manner:—50 c.c. of the sample are taken and diluted with water to about 350 c.c. This causes the precipitation of the greater part of the essential oil or resinous matter. A few drops of a strong solution of calcium chloride are next added, and this is followed by some solution of sodium phosphate, the liquid being vigorously stirred. The flocculent precipitate of calcium phosphate effectually entangles the finely divided essential oil and clarifies the liquid. The liquid is next diluted to a definite volume, 400 c.c. being sufficient if the tincture were prepared with proof spirit, but 500 is preferable if rectified spirit should have been originally employed. The solution is then thoroughly agitated and passed through a dry filter. A known measure is then carefully distilled at a low temperature, and the distillate made up exactly to the volume occupied by the liquid before distillation. The density of the distilled spirit is then taken, and the corresponding percentage of proof spirit learnt by reference to a table. Evidently the proportion of proof spirit in the original tincture will be either 8 or 10 times the amount found in the distillate, according to the extent of dilution practised.

It is convenient to state the strength of the tincture in percentages of proof spirit, as any deficiency in strength is then at once apparent, and the extent of dilution is readily calculated.

With a view of testing the accuracy of this mode of assaying tinctures, I have made various experiments. The following data indicate the extent to which the process may be relied on.

A sample of tincture of myrrh was prepared according to the directions of the Pharmacopœia, and on examination gave the following results:—

	Sp. Gravity	= Proof Spirit by volume.	= Absolute Alcohol by weight.
Spirit used for preparing tincture........	·8378	156·7	84·1
Tincture..............................	·8549	146·0	77·3
Spirit in tincture calculated from results *of distillation*		150·7	80·8
		151·0	80·9

It would appear from these results, that about 6 per cent. less of proof spirit was obtained than was present in the alcohol used in preparing the tincture, and, therefore, that the method is in error to this extent. This conclusion is not justified, for in the above calculation it is assumed that no increase in the bulk of the spirit occurs on saturating it with myrrh; but the following data show that this assumption is not warranted:—5 grammes of myrrh previously dried at 100° C. were added to 40 c.c. of rectified spirit of ·8280 specific gravity. After standing 48 hours, the tincture was filtered, the residue washed with a little spirit, dried, and weighed. Its weight was 3·142 grammes, so that 1·858 grammes had dissolved in the spirit. The density of the tincture was found to be ·8432. The weight of alcohol used was $\cdot 828 \times 40 = 33 \cdot 120$ grammes, which, added to the weight of the dissolved myrrh, gives 34·978 as the weight of the tincture. This, divided by the observed density, gives 41·4 c.c., as the measure of the tincture. Hence 100 c.c. would have increased to 103·5 c.c. In another experiment the volume was found to be 103 c.c., and in a third experiment, on double quantities, it came to 104·6. The mean of these estimations is 103·7. Thus the percentage of alcohol *found* in tincture of myrrh ought to be multiplied by 1·037 to get the true strength of that *employed* in its preparation. Applying this correction to the alcohol found by distillation of the tincture of myrrh, we obtain 156·3 and 156·6 per cent. of proof spirit, against 156·7 employed in preparing the tincture, a result which leaves nothing to be desired.

A very striking example of expansion of the fluid occurs in the preparation of the "Spirit of Camphor, B.P." In one experiment I placed 10 grammes of camphor in a graduated cylinder, and added 90 c.c. of rectified spirit of ·830 specific gravity. The tincture produced measured exactly 100 c.c., so that, as camphor has a density of ·996, 10 grammes would measure 9·96 c.c., and hence camphor dissolves in alcohol without sensible change of volume. The tincture was found by experiment to have a density of ·8446, the theoretical density, assuming no change of volume, being ·8466. Therefore the action of alcohol on camphor appears not to be strictly that of a solvent. It seems to act rather by causing liquefaction of the camphor, subsequently mixing with the resultant liquid without notable change of volume. Its action may be compared to that of chloral hydrate on camphor.

In consequence of this peculiarity, the proportion by volume of proof spirit contained in spirit of camphor will be $\frac{9}{10}$ths of that present in the alcohol used in its preparation, and there is no doubt that a similar correction ought to be applied in certain other cases.

When the modified distillation process already described is applied to spirit of camphor, the determination of the alcohol can only be affected approximately. Even when the spirit is previously diluted with 9 times its volume of water, the distillate has a distinct smell and taste of camphor. This is doubtless a consequence of the solubility of camphor in water, for the distillate obtained from tincture of myrrh retains no trace of its origin.

It is very probable that Monell's colorimetric method* might be advantageously utilized for the estimation of alcohol in spirit of camphor, but I have not been able to try the experiment.

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* *Journ. Chem. Soc., 1878, II., 246.*

I have not made any attempt to determine the camphor in a spirit or tincture containing it, but may suggest that its action on polarized light would probably afford a fairly accurate means of estimating it. The specific rotatory power of common or dextro-camphor, in alcoholic solution, is + 47·4 for the transition tint.

My attention has been recently called to the analysis of the official "Compound Tincture of Camphor," owing to the following circumstances. A medical practitioner in Sheffield had reason to suspect some compound tincture of camphor supplied him by a well-known local pharmacist, and so submitted it to a wholesale firm in London, whose chemist reported it to be deficient in alcohol and some other constituents. The medical man thereupon, through the agency of a brother practitioner, called the attention of the inspector to the matter and supplied him with a signed written order (in Latin) for 8 oz. of the tincture. In due course, the sample was procured and submitted to me, and I certified that it contained only about 34 per cent. of absolute alcohol (=71·4 per. cent. of proof spirit), instead of being made with proof spirit, and was nearly destitute of benzoic acid and oil of anise. The proportion of opium was not found to be deficient, and I expressed no opinion on the proportion of camphor. In the sequel, the vendor was prosecuted and fined £5 and costs.

From a consideration of the facts, it seems probable that the proportion of alcohol was cut down from motives of economy. The deficiency of alcohol compels a considerable reduction in the proportion of the oil of anise, as the weaker spirit used will not dissolve the half-drachm to the pint prescribed by the Pharmacopœia.

In devising a method for examining such a complex preparation as the compound tincture of camphor, it appeared desirable to analyse a number of samples of known purity. In this I have been assisted by Mr. L. Siebold, of Manchester, to whom I am indebted for the analytical results obtained by the examination of three samples of the tincture, and for a check-analysis of the adulterated sample.

In the following description, A and B are specimens of the tincture purchased by Mr. Siebold in Manchester, and probably prepared with spirit at 60° O.P. C is a sample prepared by Mr. Siebold himself. C 1 S and C 1 A are the adulterated sample as examined by Mr. Siebold and myself respectively; and C 2, C 3, C 4, and C 5 are samples purchased from well-known Sheffield pharmacists; C 5 being prepared specially for me.

The following are the densities of the original samples, without distillation or any other manipulation :—

A	B	C	C 1 S	C 1 A	C 2	C 3	C 4	C 5
·9147	·9150	·9205	*9508	·9533	·9231	·9321	·9212	·9240

From these figures it is evident that the small proportions of solid constituents present in compound tincture of camphor do not very materially affect the density, and hence that the specific gravity affords a very good approximate indication of the strength of the alcohol with which it was prepared.

However, the modified distillation process already described admits of the determination of the alcohol with all desirable accuracy, provided that a slight excess of alkali be added prior to distillation to prevent volatilization of benzoic acid. By

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[*] The quantity of tincture at Mr. Siebold's disposal was very small, and the density was determined by noting the weight of 10 c.c.

proceeding in this manner, the alcohol is obtained unmixed with anything except the 1½ grains per ounce of camphor, an amount which I have proved experimentally has no appreciable influence on the density. The clarification of the liquid with chloride of calcium and phosphate of sodium is really superfluous in the case of the compound tincture of camphor, for the small proportion of the oil of anise does not affect the density of the distillate, though it renders it milky. A useful modification of the process is to employ chloride of calcium, but to precipitate it with carbonate of sodium instead of the phosphate, and thus clarify the diluted tincture and render it alkaline at the same time.

The experiments made on the samples of compound tincture of camphor already mentioned have shown that the true percentage of proof spirit, as determined by distillation, is never more than two degrees in excess of that deduced from the density of the original tincture.

The alkaline liquid which remains in the retort after distilling off the spirit is of service for the determination of the benzoic acid. If concentrated to one-half of the volume of the original tincture employed, it should give an immediate and copious precipitate of benzoic acid on being strongly acidified by concentrated hydrochloric acid. If the acid liquid be then shaken with ether, and the upper layer of liquid removed with a pipette, the benzoic acid is readily obtained in a state of approximate purity. If the etherial layer be transferred to a small beaker, and the ether evaporated spontaneously by a current of dry air from an aspirator or bellows, the benzoic acid remains as a crystalline residue, which may be further examined. If the shaking with ether be repeated the extraction of the benzoic acid is perfect, a very fair approximate determination of its quantity may be obtained, even on as small a quantity as 5 c.c. of the tincture. Chloroform may be substituted for the ether with some little advantage. In the adulterated sample, neither Mr. Siebold nor I could detect any trace of benzoic acid; the etherial extract was but faintly acid, a re-action which proved to be due to the presence of a trace of meconic acid.

A very fair idea of the proportion of opium present in compound tincture of camphor may be obtained by diluting the sample with proof spirit and adding ferric chloride. By comparing the depth of red colour produced with that given by a standard tincture, in a manner similar to Eggertz' colorimetric method of determining carbon in steel, a good approximation to the proportion of opium can be obtained. Of course the percentage of meconic acid contained in different samples of opium is somewhat variable, and hence the determination is but approximate. A useful check is obtained by drying up a known measure of the tincture until the residue ceases to lose weight; but such a process is quite invalid if the tincture has been artificially coloured by caramel or similar material, a practice which is extremely common.

I have recently examined several samples of "Paregoric Elixir" which were found to be wholly destitute of opium. As the name "Paregoric Elixir" was formerly official, and has never been applied to any other preparation than that now represented by the compound tincture of camphor, this omission appears to be a distinct infringement of the Sale of Food and Drugs Act.*

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* Since this paper was read, two convictions have taken place at Dewsbury for selling "Paregoric Elixir" which was destitute of opium.

The proportion of oil of anise present in a sample of compound tincture of camphor may be judged of by the readiness with which the liquid is precipitated on dilution with water. With a proper proportion of oil, hardly any dilution can be effected without a milky precipitate being formed. In the case of the adulterated sample already described no precipitation occurred, no matter how much water was added. It was also proved by experiment that the proportion of oil of anise which could be dissolved in spirit of 30° O.P. was but a mere fraction of that taken up by proof spirit. Mr. Siebold found that samples A, B and C were precipitated by water even when mixed with seven volumes of proof spirit, and from this fact he estimated the proportion of oil of anise in C 1 S at less than one-eighth of the normal amount.

In addition to assistance afforded me by Mr. Siebold, I have to acknowledge my indebtedness to Mr. W. F. Cocker, who has made most of the test experiments in trial of the processes described in this paper.

NEW METHOD FOR THE EXAMINATION OF BUTTER FOR FOREIGN FATS.

By Dr. J. Koettstorfer.

[We are indebted to Dr. Dupré, F.R.S., for the following important Translation from the *Zeitschrift für Analytische Chemie*, von Dr. C. R. Fresenius, 1879, p. 199.]

The analysis of butter, according to Angell and Hehner's method, teaches us that this substance contains a far greater proportion of fatty acids with from ten atoms downwards of carbon than had previously been assumed. Since most other fats contain only the higher fatty acids, and the lower acids of the series have a smaller molecular weight than these, butter must contain more molecules of acid than an equal weight of another fat, and from the above it would appear that the difference in the number of molecules may be not inconsiderable.

Therefore it seems feasible to estimate volumetrically the number of equivalents of acids contained in butter and other fats, from the amount of K H O necessary for complete saponification, and to distinguish butter from other fats by calculating the differences in potash used.

In reality, this difference, as the experiments recorded below show, is such that it may be used for the detection of adulterated butter as readily as the difference between the insoluble fatty acids found in butter and in other fats. This new method for testing butter has the advantage over Angell and Hehner's that it is much simpler and far more rapid of execution, since an analysis may be finished in half-an-hour, provided all necessary standard solutions are ready.

The use of volumetric analysis in the examination of butter is not new. W. Heintz and Dupré * have already proposed, as modifications of Angell and Hehner's method, estimating the soluble acids by titration. By my method, however, which is based on a different principle, the whole of the acids contained in a fat are estimated by titration.

The carrying out of the new method requires a standard hydrochloric acid and a standard alcoholic potash solution. I am in the habit of using half normal hydrochloric acid and a solution of K H O in highly rectified spirit of about the same strength. As indicator I use a dilute alcoholic solution of phenol-phtalein, as recommended by Dr. E. Luck, and always add the same quantity in each experiment.

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* Dupré's method was published nearly two years before Heintz's.—Editors Analyst.

The examination of the fats is made as follows:—From 1 to 2 grammes of the fat, purified by melting and filtration, are weighed in a high beaker of about 70 c.c. capacity, 25 c.c. standard alcoholic potash are added, and the whole heated in a water-bath. When the alcohol is nearly boiling the mixture is stirred with a glass rod till all the fat is dissolved, which does not take more than a minute. The glass rod is washed with a little alcohol and put into a safe place; the beaker is covered with a watch-glass and heated further for 15 minutes, in such a manner that the alcohol does not boil too violently. At the end of the quarter of an hour the watch-glass is washed with spirit and the alcoholic solution is stirred for one minute longer with the glass rod before used, so as to saponify any fat that might still adhere to it. The solution is now taken from the water-bath, 1 c.c. of alcoholic solution of phenol-phtalein is added, and it is titrated back with half normal hydrochloric acid. The point of neutrality is very sharply indicated, the liquid becoming pure yellow when changing to the acid re-action.

From the difference between the amounts of hydrochloric acid required by 25 c.c. standard alkali and the amount used in the above titration, the amount of K H O combined with the acids of the fat is calculated.

As regards the time of heating, I have convinced myself, by repeated experiments, that five minutes, as recommended by Angell and Hehner, is not always sufficient—more particularly in the case of butter, but that a quarter of an hour is always enough to saponify fats completely and give uniform results.

Since the titre of an alcoholic potash solution is always lowered slightly when it is heated with access of air in consequence of oxidation of the alcohol, it is advisable to standardise it by heating 25 c.c. for 15 minutes in a water-bath, as in the saponification of the fat, before testing with the standard acid. The difference between the heated and unheated potash solution amounts to from $\frac{1}{20}$th to $\frac{1}{2}$ c.c. normal hydrochloric acid. The titre of the potash solution diminishes by the same amount, in the course of five to six days, at ordinary temperature, owing to the oxidation of the alcohol, and it is therefore advisable to control the potash solution from time to time.

Standard sulphuric acid cannot well be substituted for the hydrochloric acid, since this yields a precipitate of K_2SO_4, which masks the final re-action.

The saturation capacity of the acids contained in a fat might be expressed in per cents. of K H O necessary for saponification. Since, however, as shown by the experiments given below, the errors of analyses of several samples of the same fat do not alter the figures in the first decimal, it may be better to convert them into full numbers, and calculate the amount of K H O used by 1000 parts of fat. In the following experiments, I therefore give the number of milligrammes of K H O which saponify 1 gramme fat.

SAMPLES OF BUTTER FROM THE NEIGHBOURHOOD OF FIUME.

Substance 1.—	1·224	grms.	saponified	K H O	0·27868	grms.	=	on 1 grm.	fat	227·7	milligrms.	K H O.
	1·520	,,	,,	,,	0·34584	,,	=	,,	,,	227·5	,,	,,
	1·4145	,,	,,	,,	0·32119	,,	=	,,	,,	227·1	,,	,,
	1·236	,,	,,	,,	0·28101	,,	=	,,	,,	227·4	,,	,,
	1·317	,,	,,	,,	0·29827	,,	=	,,	,,	226·9	,,	,,

Mean for 1 grm. fat 227·3 milligrms. K H O.

Substance 2.—1·171 grms. saponified K H O 0·26645 grms. = on 1 grm. fat 227·5 milligrms. K H O.
1·398 „ „ „ 0·31712 „ = „ „ 226·8 „ „

Mean for 1 grm. fat 227·2 milligrms. K H O.

Substance 3.—1·436 grms. saponified K H O 0·32411 grms. = on 1 grm. fat 225·9 milligrms. K H O.
1·481 „ „ „ 0·33401 „ = „ „ 225·5 „ „

Mean for 1 grm. fat 225·7 milligrms. K H O.

Substance 4.—1·403 grms. saponified K H O 0·32556 grms. = on 1 grm. fat 232·0 milligrms. K H O.
1·257 „ „ „ 0·29266 „ = „ „ 232·8 „ „
1·237 „ „ „ 0·28741 „ = „ „ 232·4 „ „

Mean for 1 grm. fat 232·4 milligrms. K H O.

Substance 5.—1·451 grms. saponified K H O 0·32847 grms. = on 1 grm. fat 226·4 milligrms. K H O.
1·562 „ „ „ 0·35293 „ = „ „ 226·0 „ „
1·470 „ „ „ 0·33080 „ = „ „ 225·8 „ „

Mean for 1 grm. fat 226·1 milligrms. K H O.

Substance 6.—1·644 grms. saponified K H O 0·36546 grms. = on 1 grm. fat 222·3 milligrms. K H O.
1·898 „ „ „ 0·42137 „ = „ „ 222·0 „ „

Mean for 1 grm. fat 222·2 milligrms. K H O.

Substance 7.—1·885 grms. saponified K H O 0·42632 grms. = on 1 grm. fat 226·2 milligrms. K H O.
1·726 „ „ „ 0·39137 „ = „ „ 226·8 „ „

Mean for 1 grm. fat 226·5 milligrms. K H O.

Substance 8.—1·870 grms. saponified K H O 0·41447 grms. = on 1 grm. fat 221·6 milligrms. K H O.
1·855 „ „ „ 0·41176 „ = „ „ 222·0 „ „

Mean for 1 grm. fat 221·8 milligrms. K H O.

Substance 9.—1·731 grms. saponified K H O 0·39691 grms. = on 1 grm. fat 229·3 milligrms. K H O.
1·759 „ „ „ 0·40448 „ = „ „ 229·9 „ „

Mean for 1 grm. fat 229·6 milligrms. K H O.

Substance 10.—1·554 grms. saponified K H O 0·36002 grms. = on 1 grm. fat 231·7 milligrms. K H O.
1·744 „ „ „ 0·40273 „ = „ „ 230·9 „ „

Mean for 1 grm. fat 231·3 milligrms. K H O.

Clarified butter from a reliable source from Upper Austria, by feeding with green clover, September—

Substance 11.—1·966 grms. saponified K H O 0·43534 grms. = on 1 grm. fat 221·4 milligrms. K H O.
1·524 „ „ „ 0·33764 „ = „ „ 221·6 „ „
0·662 „ „ „ 0·14665 „ = „ „ 221·5 „ „

Mean for 1 grm. fat 221·5 milligrms. K H O.

Clarified butter from same source, same feeding, October—

Substance 12.—1·571 grms. saponified K H O 0·35235 grms. = on 1 grm. fat 224·3 milligrms. K H O.
1·716 „ „ „ 0·38526 „ = „ „ 224·5 „ „

Mean for 1 grm. fat 224·4 milligrms. K H O.

Clarified butter from same source, feeding with hay, November—

Substance 13.—1·585 grms. saponified K H O 0·35352 grms. = on 1 grm. fat 223·0 milligrms. K H O.
1·744 „ „ „ 0·38992 „ = „ „ 223·6 „ „

Mean for 1 grm. fat 223·3 milligrms. K H O.

If we take the clarified butter with the butters, the amount of KHO necessary for saponification varies in the thirteen estimations between 221·5 and 232·4 milligrammes for 1 gramme fat—a range of 10·9 milligrammes.

Dr. U. Fleischmann has found 85·79 per cent. and 89.73 per cent. as the limits for the acids insoluble in water. If we compare these variations of butters with those found according to my method, they will be found nearly to agree; since

221· 5: 232·4 = 85·79 : 90·01.

For comparison with butters, those fats used for the adulteration of melted butter, or for the manufacture of artificial butter, were examined. These generally contain stearin, olein and palmitin. By calculation

1 gramme stearin combines with 188·8 milligrammes K H O.
1 „ olein „ „ 190·0 „ „
1 „ palmitin „ „ 208·0 „ „

It was, therefore, to be expected that such fats would require less K H O for saponification than butter. This is found to be the case in the following analyses :—

Beef dripping prepared in the laboratory :—

Substance 14.—1·269 grms. saponified K H O 0·24985 grms. = on 1 grm. fat 196·9 milligrms. K H O.
1·449 „ „ „ 0·28421 „ = „ „ 196·1 „ „
1·507 „ „ „ 0·29644 „ = „ „ 196·7 „ „
1·909 „ „ „ 0·37448 „ = „ „ 196·2 „ „

Mean for 1 grm. fat 196·5 milligrms. K H O.

Commercial tallow—

Substance 15.—1·820 grms. saponified K H O 0·35788 grms. = on 1 grm. fat 196·6 milligrms. K H O.
1·414 „ „ „ 0·27839 „ = „ „ 196·9 „ „
1·631 „ „ „ 0·32119 „ = „ „ 196·9 „ „

Mean for 1 grm. fat 196·8 milligrms. K H O.

Lard, from kidneys, prepared in the laboratory—

Substance 16.—1.404 grms. saponified K H O 0·27480 grms. = on 1 grm. fat 195·7 milligrms. K H O.
1·344 „ „ „ 0·26354 „ = „ „ 196·1 „ „
1·658 „ „ „ 0·32440 „ = „ „ 195·7 „ „

Mean for 1 grm. fat 195·8 milligrms. K H O.

Lard, from unsmoked bacon, prepared in the laboratory—

Substance 17.—1·544 grms. saponified K H O 0.30256 grms. = on 1 grm. fat 196·0 milligrms. K H O.
1·791 „ „ „ 0·35031 „ = „ „ 195·6 „ „
1·751 „ „ „ 0·34245 „ = „ „ 195·6 „ „

Mean for 1 grm. fat 195·7 milligrms. K H O.

Commercial lard, professedly American—

Substance 18.—1·896 grms. saponified K H O 0·36982 grms. = on 1 grm. fat 195·1 milligrms. K H O.
1·991 „ „ „ 0·38963 „ = „ „ 195·7 „ „

Mean for 1 grm. fat 195·4 milligrms. K H O.

Mutton dripping, prepared in the laboratory—

Substance 19.—1·608 grms. saponified K H O 0·31653 grms. = on 1 grm. fat 196·9 milligrms. K H O.
1·706 „ „ „ 0·33604 „ = „ „ 197·0 „ „

Mean for 1 grm. fat 197·0 milligrms. K H O.

Olive oil—

Substance 20.—1·647 grms. saponified K H O 0.31653 grms. = on 1 grm. oil 192·2 milligrms. K H O.
1·703 „ „ „ 0·32644 „ = „ „ 191·7 „ „
1·309 „ „ „ 0·25068 „ = „ „ 191·5 „ „

Mean for 1 grm. fat 191·8 milligrms. K H O.

Colza oil—

Substance 21.—2·024 grms. saponified K H O 0·36080 grms. = on 1 grm. oil 178·3 milligrms. K H O.
1·593 „ „ „ 0·28508 „ = „ „ 179.0 „ „

Mean for 1 grm. oil 178·7 milligrms. K H O.

The maximum amount of K H O necessary for saponification is, according to the preceding analyses, for 1 gramme fat 197 milligrammes, and the difference from butter is large enough to be used for the approximate calculation of the percentage of other fats with which any given sample of butter may be adulterated. For example, in this place clarified butter is frequently mixed with lard. Two samples of clarified butter bought in Fiume yielded the following results—

Substance 22.—1·658 grms. saponified K H O 0·37565 grms. = on 1 grm. fat 226·6 milligrms. K H O.
1·622 ,, ,, ,, 0·36779 ,, = ,, ,, 226·8 ,, ,,

Mean for 1 grm. fat 226·7 milligrms. K H O.

Substance 23.—1.410 grms. saponified K H O 0.30197 grms. = on 1 grm. fat 214·1 milligrms. K H O.
1·390 ,, ,, ,, 0.29819 ,, = ,, ,, 214·5 ,, ,,
1·625 ,, ,, ,, 0·34711 ,, = ,, ,, 213·6 ,, ,,

Mean for 1 grm. fat 214.1 milligrms. K H O.

This shows that the first of the two samples is unadulterated, the second adulterated clarified butter: for according to the previously given analyses of various kinds of butter the minimum amount of K H O necessary to saponify 1 gramme butter equals 221·5 milligrammes.

Up to now I have, to my regret, been unable to procure any so-called oleo-margarin, from which, at present, most of the artificial butter is made. I have, however, received from Sarg some best Vienna Sparbutter (economical butter), made, according to the description which accompanied it, out of 50 kilos. oleo-margarin and 25 litres milk. Since the proportion of butter which this amount of milk could add to the mixture is scarcely 1 per cent., the result of the examination of the fat will differ but slightly from that obtained from oleo-margarin.

Oleo-margarin is obtained from beef tallow through separation of stearin. If we take into consideration the above given figures for stearin, olein and palmitin, one should expect that oleo-margarin, after the separation of stearin which combines with the smallest proportion of K H O, would require more K H O for saponification than tallow. The examination of the economical butter yielded, however, the opposite result.

Best Vienna economical butter, from Sarg—

Substance 24.—1·797 grms. saponified K H O 0·35206 grms. = on 1 grm. fat 195·9 milligrams. K H O.
1·752 ,, ,, ,, 0·34274 ,, = ,, ,, 195·6 ,, ,,

Mean for 1 grm. fat 195.8 milligrams. K H O.

The addition of about 1 per cent. butter increases the amount of K H O necessary, by 0·2 to 0·3 milligramme; 1 gramme oleo-margarin, from which the sample of economical butter was made, would therefore have required 195·5 milligrammes K H O for complete saponification.

Beef tallow requires, according to the analyses given under Nos. 14 and 15, 197·7 milligrammes K H O. It seems, therefore, that in the manufacture of oleo-margarin, somewhat more palmitin than stearin is separated: for, if stearin were chiefly removed, the oleo-margarin would require more K H O for saponification than tallow.

As lard, according to experiments 16, 17 and 18, requires nearly the same amount of K H O for saponification as oleo-margarin, and butter is mostly adulterated with these two substances, we may take the number 195·5 as the basis for calculating the amount of adulteration of a given sample of butter.

According to the experiments given under Nos. 1—13, the amount of K H O necessary to saponify 1 gramme butter or clarified butter, varies between 221·5 and *232·4 milligrammes.* We may, therefore, pass butter as pure, 1 gramme of which requires 221·5 milligrammes or more of K H O for saponification, but as impure if it combines with less K H O. For calculating the amount of admixed foreign fat, the mean of the two extreme values found for butter, namely 227, will probably be best. If we call X the percentage of admixed fat, and N the number of milligrammes of K H O, which the sample of butter under examination requires for saponification, we obtain

$$(227 - 195{\cdot}5) : (227 - n) = 100 : x \text{ ; and } x = (227 - n) \times 3{\cdot}17.$$

In the calculation of the percentages of admixed foreign fats similar differences are found, owing to variations between various samples of butter, as in the method of Angell and Hehner. If, for example, in calculating experiment No. 23, we take for butter the lowest figure, viz., 221·5 then X = 29 per cent. But if we take the highest, viz., 232·4, the result is 50 per cent., and by using the mean 227, the admixed foreign fat would come to 40 per cent. We might, therefore, if we calculate with the mean number of 227, make a mistake of 10 per cent. Under the most unfavourable condition, 29 per cent. foreign fat might escape detection; namely, if butter which required 232·4 milligrammes K H O has been employed, and the adulterated butter equires 221·5 milligrammes K H O for saponification. By using Angell and Hehner's method, 40 per cent. might, under these conditions, escape detection.

Irrespective of the ease with which butter may be examined by this new method, it will in some cases also furnish an insight into the constitution of fats.

Besides this, this method may give a means of distinguishing between fats for which the proportions of K H O necessary for saponification differ sensibly. Thus, in the above experiments on olive oil and colza oil, the numbers 191·8 and 178·7 were obtained, differing by 13·1. If once the extreme values have been fixed by a sufficient number of experiments for these two oils, we may use the difference between the numbers so fixed, not only for the detection of an adulteration of olive oil by colza oil, but also for calculating approximately the amount of adulteration.

I reserve for a future time the continuation of the experiments on fats in this direction, and the publication of the results in due course.

FIUME, *November, 1878.*

A NEW METHOD OF DISTINGUISHING BUTTER FROM SOME OTHER FATS.

By WILLIAM GUSTAVUS CROOK, *Public Analyst for Norwich.*

HAVING been lately specially engaged in examining several kinds of fat for the purpose of identification, I will, as briefly as I am able, describe a method arrived at, which will in a few minutes distinguish butter from the fat of beef, mutton, or pork, or mixtures of them. The sample to be examined (if in the form of butter) must be first melted and rendered pretty free from water and salt, by filtration if necessary; ten grains are then to be put into a test tube, and liquified by placing the tube in hot water at about 150° F.; remove the tube when ready, and add thirty minims of carbolic acid (Calvert's No. 2 acid, in crystals, one pound; distilled water, two fluid ounces). Shake the mixture, and again place it in the water-bath until it is transparent. Set the tube aside for a time. If the sample thus treated be pure butter, a perfect solution will be the result; if beef, mutton, or pork fat, the mixture will resolve itself into two solutions of different densities, with a clear line of demarcation: the denser of the two solutions, if beef fat, will occupy about 49·7; lard, 49·6; mutton, 44·00 per cent. of the entire volume; when sufficiently cooled, more or less deposit will be observed in the uppermost solution. If olive oil be thus tested, the substratum will occupy about 50 per cent.; with castor oil, there is no separation. With some solid fats (not likely to be used fraudulently) no separation whatever takes place; the addition of a minute portion of alkanet root will render the reading of the scale extremely distinct by artificial light. The above method (although not intended to surpass other processes) is capable of wide application, the saving of a large amount of time, and the reliability of its results will at once recommend it as a "first step" in butter analysis.

INSTITUTE OF CHEMISTRY.

We have received the reports of the discussions which took place on 27th February and 2nd April, on the subject of the Adulteration of Food. We believe this is the first work, partaking in any degree of a scientific character, which has been undertaken by the Institute since its formation; and it would, therefore, be hardly just to criticise the matter as closely as the proceedings of an older society, and the more so because by reason of the mistaken preference which the Institute has shown for secret meetings, and the rigid exclusion of visitors, several chemists who could have given really useful information were unable to be present. We suppose that this rule will be relaxed in future, since it seems improbable that the Council will exclude visitors from hearing what they can afterwards read, unless indeed the accommodation should prove to be too limited for the members attending. This, however, seems unlikely.

The discussion was opened by Dr. Voelcker, whose speech extends to some thirteen pages; we can, therefore, only briefly notice some of its salient points. Dr. Voelcker said there was no difficulty in determining "whether milk had been adulterated with a considerable quantity—say 20 per cent.—of water, or whether skimmed milk had been sold as fresh." "In cases of that kind, the chemical or microscopical examination of the articles in question decides, with certainty, whether they are genuine or adulterated." This, however, hardly accords with a statement a few lines lower. "I need hardly say that it is now admitted by all persons who possess some knowledge of dairy matters that the composition of equally genuine samples of milk varies greatly." The speaker then went on to refer to his old milk experiments at Cirencester, in 1863, and again quoted his analyses of the milk from the half-starved cows, bringing the produce of these wretched animals forward to show how variable milk is. He then referred to the limits laid down some years ago by the Society of Public Analysts, calling them, however, by the erroneous name of "standards." After acknowledging that some analysts, "no doubt very young and inexperienced," had challenged the accuracy of his analyses, he said that the "best informed" of his opponents had altered their views on the milk question, and come round to his own. After a well-deserved passing sneer at half-crown milk analysts, Dr. Voelcker stated that he objected *in toto* to all milk standards, and characterised the present one as "somewhat low." Four pages of the report are then occupied with a reprint of part of an old paper on the importance of the hydrometer for determining the adulteration of milk, and another page with an old paper on cream. Dr. Voelcker, carefully avoiding making any remarks which were capable of criticism in reference to butter, bread, tea, coffee, cocoa, or arrowroot, referred to the well-known selenite water used in making the Worcester vinegar; and then passing rapidly over colouring matters, metallic poisons, salicylic acid, and spirits, concluded by pointing out what in his view was the absurdity of fining a man for 80 grains of salt per gallon in beer.

The President (Dr. Frankland) followed with a few remarks, of which the most novel was the statement that, in taking the specific gravity of milk, "the quantity of fat present would exercise no influence on the indications of the lactometer."

Dr. Dupré pointed out the error into which Dr. Voelcker had fallen, in calling the limits fixed by the Society of Public Analysts "standards," and remarked on the special attention which had been paid to these limits in Germany as compared with the consideration they had received in England. Referring to the milk question, he remarked that milk from under-fed cows was certainly not of the nature, quality, and substance demanded. He considered that Dr. Voelcker's analyses of the milk of such cows had done much harm. In reference to alumina in bread he considered it impossible to lay down a proper limit, except by the comparison of the silica with the alumina present. He pointed out that in the case of flour it was easy to determine the alum by means of his process, already published in THE ANALYST. Referring to butter, Dr. Dupré again pointed out the fallacious inferences which may be drawn from the sp. gr. only, when mutton fat has been used as an adulterant, and urged the necessity of the determination of both insoluble and soluble acids. With reference to the fines inflicted by some magistrates he remarked that, by the addition of only 10 per cent. of water to the milk consumed in London, the sum of £150,000 a year would be paid for water. He concluded with a few observations as to the changes which may take place in drugs by long keeping.

Dr. Stevenson regretted that Dr. Voelcker's paper referred to so few subjects, and introduced so little new matter; he believed that Public Analysts as a body were as trustworthy as the members of any other profession. He thought it would have been well had Dr. Voelcker's analyses been made by modern methods instead of by methods now scarcely ever adopted by analysts, and considered that the milk of fairly-fed cows did not present that wide difference which they had heard of that evening.

Dr. Redwood thought that spirits should be kept within certain limits, in order to justify the application to them of their popular names. He appeared to think that 30 U.P. was a fair and proper strength for gin, and that lower than that should not be allowed. He justified the addition of annatto to butter and cheese for the purpose of colouring them, but condemned the colouring of pickles with copper.

Dr. Tidy objected to a standard in which the analysis of any article as a whole was not taken account of. He stated that, on referring to Dr. Letheby's old note books, he found that he (Dr. Letheby) examined the milk yielded by two cows for 115 consecutive days. The solids not fat in the milk of one cow never fell below 9 per cent., but in the milk from the other cow, on four different occasions, the amount of solids not fat was less than 7·5 per cent. He thought, however, there were ninety-nine chances in a hundred that milk which gave such a figure as this was adulterated. He gave some interesting statistics as to the average total solids found in human milk in health and disease, which led him to the opinion that in some cases the children of diseased women appeared to thrive on milk which contained far less total solids than in other cases where the proportion was abnormally high.

Mr. Bell stated that at Somerset House they did not subscribe to the limits laid down by the Society of Public Analysts, because having taken great trouble to investigate the subject of milk, they had found considerable variations in its composition, and that no one constituent forms a constant quantity in genuine milk. In judging whether a milk had been watered or not they took the whole of the constituents into account, and formed from these an opinion as to the genuineness or otherwise of the sample.* Mr. Bell then gave some statistics of the examination which they had made of the character of various samples of milk, which are no doubt of interest, but would have been more so had they been given in a rather more intelligible form. The net result appears to be, that in the case of individual cows 4 per cent. yielded less than 11 per cent. of total solids, and 18 per cent. less than 8·6 per cent. of solids not fat; while in the case of dairy mixture 20 per cent. showed less than 12 per cent. of total solids, and 12 per cent. contained less than 8·6 per cent. of solids not fat. In the case of individual cows only 6 per cent. yielded less than 2·5 per cent. of fat, and in the case of dairy mixtures only 4 per cent. were found to contain under 3 per cent. of fat. Mr. Bell evidently considered the Society's limit of 2·5 per cent. fat in milk too low. It appears to us a singularly unfortunate thing, that when Mr. Bell was asked to meet the Society of Public Analysts, in order to give them the very information contained in this speech, and to discuss the matter with those who are presumably most capable of dealing with the subject, he should have sheltered himself behind a letter from the Inland Revenue Commissioners stating that they did not "think it expedient" he should meet the Society, and then that Mr. Bell should have brought these statistics forward on an occasion when they could scarcely be discussed with equal knowledge or authority. After a few remarks with reference to the question of salt in beer the discussion was adjourned.

In resuming the discussion on April 2nd, Professor Attfield said he thought a good deal more should be done towards settling the limits or standards. After hearing the remarks of Dr. Voelcker and Mr. Bell, he thought they ought to be revised. He could not subscribe to the statements of the Society. Professor Attfield then criticised at some length the "limits" of the Society, asking whether even salt must be sold free from arsenic.

A communication was then read from Mr. Angell on the subject of milk, supporting the Society's standard of 9·0 solids not fat.

Mr. Hehner somewhat severely criticised Dr. Voelcker's and Mr. Bell's figures, and pointed out that it was incredible that Public Analysts all over the country should have made such an erroneous estimate as 9·0 of solids not fat in milk, as was implied by Mr. Bell's statements. He also denounced the sp. gr. of fat process as unreliable for butters, and traced the high percentage of fatty acids sometimes found at Somerset House to imperfect washing. He concluded by protesting against "secret" methods of analysis.

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* We fancy this remark of Mr. Bell's must be misreported, for a copy of a certificate relating to a milk sample is now lying before us signed by Mr. Bell and his coadjutors, and bearing a date in last month, in which certificate no determination of ash is given, and no estimation of the constituents contained in that ash, and this notwithstanding that the milk had been condemned by a Public Analyst, *partly because salt or other* preservative material had been added to it.—EDITORS ANALYST.

Dr. Dupré pointed out that in every case in which he had received a milk containing less than 8·6 per cent. solids not fat, he had given a certificate of adulteration; and in all those cases a prosecution had ensued, and a fine had been inflicted and paid; a pretty conclusive proof that the vendors did not dare to appeal. He then brought forward some experiments which entirely controverted the remarks of the President as to the effect of cream on the hydrometer.

Dr. Alder Wright made a few remarks in reference to the hydrometer to the same effect.

Mr. Neison put the hydrometer question in a still more intelligible form, and pointed out that it was simply a measure of the weight of the column of liquid above it.

Mr. Bannister referred to certain articles in THE ANALYST, to show that the term standards was sometimes used instead of limits even in this journal; but his quotation seems to us to apply really to Mr. Wanklyn's "standard," not to the Society's "limit." He then referred to two well-known old cases in which analysts had unquestionably made mistakes, both of which cases were immediately and promptly dealt with by the Society of Public Analysts. Of this latter fact Mr. Bannister made no mention.

After a few remarks from Dr. Dupré, expressing surprise at some remarks of Mr. Bannister's, Mr. Helm did little more than reiterate Mr. Bell and Mr. Bannister's statements in reference to milk. He complained however of the low fines when samples were proved to be adulterated, and introduced a personal element into the matter, by pointing out that his own milkman had just been fined.

After Mr. Bell had again defended the sp. gr. test for butter, Dr. Alder Wright said he thought the amount of added water should be calculated from the limit used in the case of milk, and not from the average results of general samples; but, from his remarks, it would appear that he did not understand that this was the course almost invariably taken by Public Analysts. He then referred again to the hydrometer, and clearly showed that the statements first made about it were incorrect.

The President, in his concluding remarks, appeared to think that the troublous times of the Public Analysts were coming to a conclusion, and that chemists were rapidly converging to fairly unanimous opinions as to the processes and limits or standards. He thought there should be a difference between the fine inflicted upon the man who intentionally adds water to his milk and the man who sells milk from a poor cow; and therefore he thought there should be two standards, one of average quality and one of minimum, and that any milk falling between the two should be regarded not as adulterated but as not of the quality demanded. The President then made some rather strong remarks in reference to low fees paid for analytical determinations, such for instance as 2s. 6d. or 5s., and the discussion was concluded with a vote of thanks to Dr. Voelcker, and its acknowledgment by him.

SALE OF FOOD AND DRUGS ACT (1875) AMENDMENT BILL.

The following is a Copy of the Bill introduced into the House of Commons by Mr. Anderson as amended by the Select Committee.

WHEREAS conflicting decisions have been given in England and in Scotland in regard to the meaning and effect of section six of the Sale of Food and Drugs Act, 1875, in this Act referred to as the principal Act, and it is expedient, in this respect and otherwise, to amend the said Act: Be it enacted by the

Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

1. This Act may be cited for all purposes as the Sale of Food and Drugs Act Amendment Act, 1879.

Short title.

2. In any prosecution under the provisions of the principal Act for selling to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality of the article demanded by such purchaser, it shall be no defence to any such prosecution to allege that the purchaser, having bought only for analysis, was not prejudiced by such sale. Neither shall it be a good defence to prove that the article of food or drug in question, though defective in nature or in substance or in quality, was not defective in all three respects.

In sale of adulterated articles no defence to allege purchase for analysis.

3. Any street or open place of public resort shall be held to come within the meaning of section seventeen of the principal Act.

Extension of Act as to sale in streets, &c.

4. In determining whether an offence has been committed under section six of the said Act by selling, to the prejudice of the purchaser, spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit more than twenty-five degrees under proof for brandy, whisky, or rum, or thirty-five degrees under proof for gin.

Reduction of spirits allowed to the extent of 25 per cent. under proof.

5. Every liberty having a separate court of quarter sessions, except a liberty of a cinque port, shall be deemed to be a county within the meaning of the said Act.

Extension of meaning of "county."

6. The town council of any borough having a separate court of quarter sessions shall be exempt from contributing towards the expenses incurred in the execution of the principal Act in respect of the county within which such borough is situate, and the treasurer of the county shall exclude the expenses so incurred from the account required by section one hundred and seventeen of the Municipal Corporation Act, 1835, to be sent by him to such town council.

Quarter sessions boroughs not to contribute to county analyst.

7. The town council of any borough having under any general or local Act of Parliament, or otherwise, a separate police establishment, and being liable to be assessed to the county rate of the county within which the borough is situate, shall be paid by the justices of such county the proportionate amount contributed towards the expenses incurred by the county in the execution of the principal Act by the several parishes and parts of parishes within such borough in respect of the rateable value of the property assessable therein, as ascertained by the valuation lists for the time being in force.

Provision for boroughs with separate police.

8. In all prosecutions under the principal Act, and notwithstanding the provisions of section twenty of the said Act, the summons to appear before the magistrates shall be served upon the person charged with violating the provisions of the said Act within a reasonable time, and in no case exceeding twenty-eight days from the time of the purchase from such person for test purposes of the food or drug, for the sale of which in contravention to the terms of the principal Act the seller is rendered liable to prosecution, and particulars of the offence or offences against the said Act of which the seller is accused, and also the name of the prosecutor, shall be stated on the summons, and the summons shall not be made returnable in a less time than seven days from the day it is served upon the person summoned.

Special provision as to time for proceedings.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—My short "Note on Violet Powder" evidently contains some wholesome truths which have proved very unpalatable to various of your readers, since their anger has made them forget logic, fairness, and even ordinary propriety. With such I can of course not enter into any discussion, but I would ask for space to assure your correspondents, "The Manufacturers of the Steamer Over a Globe Violet Powder," that I am not above learning even from manufacturers of scented selenite powder. If they will, therefore, kindly point out the fallacies and erroneous conclusions contained in my Note, I will carefully consider their statements, and should I find them correct will alter my own accordingly.

I must, however, at once protest against the assertion that I have included arsenic as among the constituents of various violet powders.

I remain, yours, &c.,

A. DUPRÉ.

To the Editor of "The Analyst."

Sir,—As you have called upon me to produce whatever evidence I may have relating to the nature of the saccharine substances contained in malt wort, and to the detection of cane sugar in wort, will you give me space to say that I have for a long time past been actively engaged in investigating the matter, and have notes of a very large number of experiments, showing, analytically, that the sugar of wort is *maltose*, not glucose. But, since my experiments cannot be compressed into the narrow compass of a letter, I trust to be allowed to give them at length at an early meeting of the Society of Public Analysts.

As far as I could ascertain, the method adopted by the Somerset House chemists to determine the quantity of cane sugar in wort consists in boiling the wort for a few minutes with a little dilute sulphuric acid, by which treatment dextrin is said not to be affected, cane sugar being converted into glucose, the increase in the amount of saccharine matter capable of reducing Fehling's solution being calculated as cane sugar.

How faulty and untrustworthy this method is, especially when only comparatively small quantities of cane sugar are in question, I am ready to show. I remain, yours obediently,

OTTO HEHNER.

THE BATH MILK PROSECUTION.

With reference to this case, reported on another page, our readers will probably be interested in the results of Mr. Gatehouse's experiments, as detailed in the following report:—

The City Analytical Laboratory, 36, Broad Street, Bath, May 9th, 1879.

I, the undersigned Public Analyst for the city and borough of Bath, hereby certify that on Thursday, May 1st, 1879, Mr. Francis, of Compton Dando and the Bath Market, brought to my laboratory a tall can (about four feet high) full of milk for experimental investigation. This milk at 9.15 a.m. he proceeded to transfer in my presence into another vessel by means of an ordinary tin milk cup, dipping at intervals of a few minutes so that in the course of two and a half hours he had transferred in this manner 25 quarts, being about one-half the quantity originally in the tall tin. He also at the same time delivered to me a bottle of milk taken from the same tin at the time it was put therein at his farm. Having analysed the milk in the bottle and also samples of that taken from the tin when first opened and when the dipping was completed, I found the following results:—

Milk from the bottle as originally placed in the tin.		Milk from the top of the tin as received at 9.15 a.m.		Milk remaining in the tin at 11.50.	
Water..........	86·92	Water..........	74·20	Water..........	89·50
Fat............	3·2	Fat............	16·03	Fat............	·78
Solids not fat ..	9·88	Solids not fat ..	9·77	Solids not fat ..	9·72
Cream	15 per cent.	Cream	95 per cent.	Cream	4 per cent.

On Monday, May 5th, Mr. Francis at my request supplied me with eight quarts of milk in a milk can of ordinary construction, as used for selling milk in the streets. Five quarts of this milk I transferred during a space of three hours by dipping at intervals of a few minutes *from the top of the milk*, so as to disturb the cream as little as possible, and made the three following analyses of different portions thereof:—

8·15. Milk as originally in the tin.		Milk taken from the tin at 10·45.		Milk remaining in the tin at 12·15.	
Water	87·4	Water	87·3	Water	87·55
Fat	13·2	Fat	3·4	Fat	2·8
Solids not fat..	9·4	Solids not fat....	9·3	Solids not fat....	12·45
Cream	13 per cent.	Cream	15 per cent.	Cream	9 per cent.

From these facts I conclude:—1. That the milk originally placed in the tall tin, received by me on May 1st, was of excellent quality. 2. That this milk had been standing in the tin for a considerable time before it was received, and that its removal from place to place was not sufficient to prevent the cream rising to the surface and remaining there. 3. That by selling milk from such a tin without taking care to mix the contents occasionally, the milk is ultimately reduced to the state of "skim milk," losing the greater part of its fat by the cream rising. 4. That by selling milk from the ordinary open tin in the usual manner, no appreciable difference occurs in the quality of the milk.

(Signed) J. W. Gatehouse.

Mr. J. Napier has been appointed Public Analyst for Bury St. Edmunds.
Mr. W. W. Stoddart has been appointed Public Analyst for the Borough of Chard.
Dr. W. Morgan has been appointed Public Analyst for the Borough of Neath.

LAW REPORTS.

Spirits of Nitre and Cream of Tartar.—John Pennock, grocer, of Norton, was charged at the County Petty Sessions, at Stockton, with selling adulterated spirits of nitre and cream of tartar. Mr. C. H. Archer, of Stockton, defended. Supt. Bell, inspector under the Act, stated that on the 4th February he purchased six ounces of spirits of sweet nitre at the defendant's shop. He told the defendant it was for purposes of analysis. He divided it into three portions, one of which he gave to the defendant, the second he retained, and the third he sent to Mr. Edger, of Newcastle, the County Analyst, who certified it to contain 25 per cent. more water than genuine nitre contained. There was a fair proportion of nitrous ether. On the same day he purchased four ounces of cream of tartar, and the same process as mentioned in the first case was gone through. Mr. Edger certified the article to contain an excess of tartrate of lime—tartrate of lime, 8·5 per cent.; sand, 1·2 per cent.; sulphate of baryta, 17 per cent. He produced the analyst's certificate in each case. Mr. Archer said that in the first case his defence was that although the nitre was of inferior quality it was a commercial article, and of the quality usually sold. The first quality of nitre was seldom produced, the second was usually sold in town, and the third was generally sold in the country for cattle. Mr. Bell paid for an inferior article, and he was entitled to no better quality than he got. Mere inferiority was no ground on which to convict a man under the Act, and he therefore asked the bench to dismiss his client. As to the cream of tartar, the tartrate of lime was left in through the mode of production; and the article, like the nitre, was sold precisely as it was got in the first instance. Mr. Dodgson, of the firm of Mandale, Dodgson and Co., bore out Mr. Archer's remarks as to the nitre, and added that people objected so much to paying for a superior quality that it was seldom offered; cream of tartar, he explained, was produced from the crust of wine. The crust of red wine was cleared by means of white clay, and there usually remained a certain amount of tartrate of lime, and not unfrequently a small quantity of the clay. He supplied the defendant with the nitre, and the cream of tartar. Supt. Bell: And of course you are consequently anxious that there should be no conviction. The bench said they were satisfied that there had been an infringement of the Act, but it was not a serious one. They fined the defendant 1s. and costs in each case. J. Clay, general dealer, of Norton, was also charged with selling adulterated nitre. Supt. Bell stated that in this case the analyst had certified the sample to contain 24 per cent. more water than was contained in genuine nitre. Cream of tartar purchased at the defendant's was found to be much better than that sold by Mr. Pennock; it was nearly pure, and a summons had, therefore, not been taken out. —The Defendant said he sold the nitre exactly as he got it from the wholesale grocers. The Bench: We fine you 1s. and costs. You must not sell any more of this unless you tell people what it is.

Alum in Bread.—George Allen, baker, of Walsall, was summoned at the instance of Mr. C. W. Stephens, sanitary inspector, for selling an article of food not compounded of the ingredients demanded, and also for selling bread containing alum, so as to be injurious to health. The inspector stated that he purchased a two-pound loaf at the shop of defendant, and forwarded it to Mr. E. W. T. Jones, the Borough Analyst, whose certificate of analysis he produced. The certificate showed that the loaf was adulterated with alum in the proportion of 36 grains to the four-pound loaf, and that such adulteration would tend to render the bread indigestible. Dr. J. Maclachlar, medical officer of health, gave it as his opinion that the quantity of alum stated would be likely to make bread injurious to health. Addressing the Bench for the defence, Mr. Nanson said he did not dispute that there was alum in the loaf, but he urged that none was put in by the defendant or at his establishment, and that the flour was used just as it came from the miller. The Bench, after hearing the defendant, considered the case proved, and imposed a fine of £5 and costs (including professional charges), on the first summons, the other being withdrawn. The fine and costs amounted to £7 14s.

Adulterating Milk.—William Berridge, farmer, of Duntox Bassett, near Lutterworth, Leicester, was summoned for selling milk adulterated with water. Mr. Ricketts, solicitor, prosecuted on behalf of the Metropolitan Dairymen's Society; Mr. Louis Lewis appeared for the defence. Mr. Ricketts said that the prosecutor in this case—Mr. Thomas Gibson, of Walbrook Dairy, East Road, City Road—was a member of the Dairymen's Society, and had contracted with the defendant to supply him with milk every day, which was delivered at the Midland Railway terminus. In consequence of some suspicion which he entertained as to the quality of the milk he communicated with the society's officer. Mr. Parish, who took a sample of some of the milk in a bottle on its arriving at the St. Pancras Station, when it had become the property of Mr. Gibson. The sample was taken to Dr. Stevenson, Public Analyst, who, upon examining it, found it to be adulterated with 14 per cent. of added water. Witnesses having been called to bear out Mr. Ricketts's statement, Mr. Barstowe said this was the kind of offence he wished to get hold of. As there appeared to have been no complaints made in the neighbourhood where the defendant carried on his business, he would inflict a somewhat mitigated penalty. He had power to impose a fine of £20. The costs had been heavy in this case, and amounted to £10 10s. and this, with a fine of £5, was the penalty he would inflict. The fine was at once paid.

Skimming Milk.—At the Bath Police-court, before the Mayor and other magistrates, Henry Francis, dairyman, of the Market, was summoned for selling milk, which was not of the nature, substance, and quality demanded. Mr. F. H. Moger and Mr. F. S. Clark defended. Mr. Moger stated that Inspector Montagu, on the 8th May, bought at a stall, which defendant kept in the market, some milk. Mr. Montagu informed the person in charge of the stall that it was purchased for the purpose of being analysed, and divided the sample into three parts. The inspector took a portion to the Public Analyst, Mr. Gatehouse. The certificate of Mr. Gatehouse certified that "I received, on the 8th day of April, 1879, of Mr. H. G. Montagu, a sample of milk in a sealed bottle, labelled No. 5, signed H. G. M., for analysis, which then weighed seven ounces, and have analysed the same, and declare the result of my analysis to be as follows :—Water, 89·79 ; fat, 1·13 ; casein, sugar, &c., 8·40 ; ash, ·68 ; cream, 4 per cent. by volume. I am of opinion that the same is a sample of milk which is deficient in fat to the extent of 55 per cent." Mr. Gatehouse was examined in support of his certificate ; and the defendant was then called, and accounted for the absence of fatty matter by constant dipping in the can which contained the milk, and from which milk had been sold four and a-half hours before the sample in question was taken from it, and undertook to supply Mr. Gatehouse with a can of milk to experiment upon, Mr. Gatehouse considering that the constant dipping would, to a certain extent, mix the cream with the milk. After consulting privately together, the Mayor announced that the Bench could not agree on a decision, and therefore the case would be dismissed.

NOTES OF THE MONTH.

The unintentional skimming of milk (first brought forward as a good defence in cases where a milkman was charged with selling skimmed for fresh milk, on the occasion of a certain learned professor's now historical ride in a milk cart) has again cropped up in Bath ; and in an elaborate report, Mr. Gatehouse has concluded that, under certain circumstances, such involuntary fraud is quite possible. In the face of this defence, it is certain that no prosecution for skimming milk can ever lie, but, in the interests of the public, we would suggest that when it is next offered, the prosecution should argue that an essential point in the business of a purveyor of milk is to use such vessels and such precautions as will secure that his final customers shall not be robbed to the advantage of the first; and that, no matter whether it be done wilfully, or only by want of due precaution, the offence of selling to the prejudice of the latter purchasers remains the same, and conviction should follow. Of course, if the magistrate is satisfied that it was a case not of criminal intent, but only of contributory negligence, then he can take that as a plea *ad misericordiam* in fixing the fine.

A recent case in which a sample of milk was sent to Somerset House for analysis throws some light on the differences in the deductions which the Inland Revenue chemists have drawn from their analyses, and those obtained by Public Analysts.

A sample of milk was analysed by a Public Analyst in April. In May the sample was sent to Somerset House, but previously to sending it the bottle was opened by the inspector, and a portion of its contents removed by him in the presence of two analysts, one of whom examined the portion removed. The bottle was then re-sealed by the inspector, and forwarded the same day to the Inland Revenue Laboratory. The results obtained were as follows—

	First Analyst.	Second Analyst.	Somerset House.
Solids not fat	7·78	7·58	7·14
Fat	2·50	2·42	2·38
Ash	·87	·86	Not determined.
Cl. in Ash	·23	·22	ditto.
Opinion	15 % water.	15 % water.	10 % water.

The interest of the analyses lays mainly in the fact that the second analyst and the Somerset House chemists received the sample within a few hours of each other. It was then a month old, and the difference between the first and second columns shows the change it had then undergone, but the Somerset House chemists find, either on the same day or the next, ·44 less solids not fat than No. 2 analyst; or as nearly as may be the same difference as exists between their standard results and the results of Public Analysts generally. This points to the source of the discrepancy: their solids not fat are evidently dried at too high a temperature, or too long.

We have pleasure in drawing the attention of our readers to the abstract which we print of the discussion which took place before the Institute of Chemistry on the subject of Food Adulteration, and we write this none the less sincerely, although we note with regret that but little new matter was brought forward by the various speakers. Indeed, the most striking feature in the whole discussion seems to have been, in the first instance, an attempt to ignore all the work which had been done by the Society of Public Analysts, although it amounted to as many thousands of analyses as the number of speakers present could claim to have made hundreds. After a short time, however, it became evident that the work of Public Analysts must be referred to, notwithstanding this attempt to ignore it, and we certainly have nothing to complain of in the criticism which it received. Coming from such a quarter, the criticism was sure to be severe, but that seems to us immaterial, for no statement put forward by the Society as a definite fact appears to have been in any way disproved. It would have been much better if the discussion had been an open one, so that a little new information might have been thrown on the subject.

Apropos of this discussion, it is a very singular thing that the President of the Institute should appear to think that Public Analysts, as such, are the gentlemen who are under-bidding, and therefore lowering the status of the profession. Practically, this is not so. We do not know of a single instance in which a Public Analyst does not get remuneration—say, for instance, for milk analyses—which is not above that accepted by some persons—it may be even by members of the Institute itself—for analyses of samples from private customers. True, the 2s. 6d. fee is named in the Act, but this fee is meant to be, and practically is in every case, supplemented by a respectable yearly salary. Is this the case always in reference to private work? Could not the Institute take this subject up and look carefully into it? Some of its influential members would be able to give important and valuable information on this point, even though they fairly and honestly admit their lack of experience in reference to food analysis.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
2776	W. Weldon	Manufacture of Soda and Potash	4d.
3621	W. Weldon	Manufacture of Alkaline and Earth Metal Cyanides	2d.
2840	P. Spence and T. Illingworth	Manufacture of Sulphate of Ammonia	2d.
3397	H. Kenyon	Purifying Coal Gas and Manufacturing Carbonate of Ammonia	2d.
3844	C. M. Sombart	Producing Iodine and Brome	4d.
3900	E. G. Brewer	Manufacture of Cements	2d.
3917	J. H. Johnson	Apparatus for Compressing Ammoniacal and other Gases	6d.
3967	J. Imray	Manufacture of Potassa and Soda Carbonates from Potassium and Sodium Chlorides	6d.
3973	G. Glover	Destroying, &c., Deleterious Compounds formed during Manufacture of Soda Ash	4d.
4003	A. McDougall and J. Hepworth	Purification of Gas and Separation of products therefrom	2d.
4019	A. Rowan	Manufacture of Cement	2d.
5255	W. Morgan-Brown	Phosphorescent Powders, &c.	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; The Anti-Adulteration Review; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; Estimation of Phosphoric Acid and Magnesia, by *Messrs. Teschemacher and* Denham Smith; Organic Chemistry, by Hugh Clements; Analytical Notes *by Dr. Bernays.*

THE ANALYST.

JULY, 1879.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, Piccadilly, on Wednesday, June 4th, the President, Dr. Muter, M.A., F.C.S., in the chair.

The minutes of the previous meeting were read and confirmed.

Mr. W. F. H. Pocock, Analytical Chemist of Cape Town, Cape of Good Hope, was proposed for election as a Member.

Dr. Dupré gave notice of his intention to propose a Resolution at the next Meeting in reference to the appointment of a Foreign Secretary.

Dr. Dupré read a paper "On the Examination of Spiritus Ætheris Nitrosi."

Mr. Wigner read a paper by Mr. J. Carter Bell, "On the Analysis of Flour and Bread."

And also a paper by Mr. A. Wynter Blyth, "On the Analysis of Devonshire Cream."

The next Meeting of the Society of Public Analysts will be held at Sheffield, during the Meeting of the British Association, early in August next.

NOTE ON THE EXAMINATION OF SPIRITUS ÆTHERIS NITROSI.

BY A. DUPRÉ, PH.D., F.R.S.

Read before the Society of Public Analysts, on 4th June, 1879.

HAVING at various times been asked for explanations as to the method I use for estimating the amount of nitrous ether, contained in a sample of Spiritus Ætheris Nitrosi, I take this opportunity of describing the method once for all. The principle of the method will be found in *Duflos Apothekerbuch*, Edition 1867, p. 251, and I have simply worked out the details a little more fully. For the present I confine myself to the analytical method, and must leave many points of interest connected with the subject to some future time.

Spiritus Ætheris Nitrosi, as is well known, is directed to be prepared *(Brit. Pharm.)* by distilling a mixture of spirit, nitric and sulphuric acids and copper, and mixing the distillate obtained with a certain proportion of spirit. If all the nitric acid employed were used up in the formation of nitrous ether, the proportion of such contained in the finished product, if two pints of spirit are added to the 15 ozs. of distillate, would amount to about 6·5 per cent. In practice this result is, however, never obtained; and, according to my experience, we may consider a product containing 8 per cent. of nitrous ether as fairly representing the B.P. preparation.

In judging of the purity, or otherwise, of any given sample of Spiritus Ætheris Nitrosi, B.P., the particular method of manufacture adopted in the preparation of the sample is, of course, perfectly immaterial: as long as it fairly corresponds in strength to the B.P. standard, it must be considered as of the nature, substance and quality demanded, however produced.

Characters. B.P. Transparent, very slight tinge of yellow. Specific gravity, 0·845. Effervesces feebly, or not at all, when shaken with a little bicarbonate of soda. When agitated with a solution of sulphate of iron, and a few drops of sulphuric acid, it becomes olive brown or black. If it be agitated with twice its volume of saturated solution of chloride of calicum in a closed tube, two per cent. of its original volume separate in the form of nitrous ether, and rise to the surface of the mixture.

Further Tests of Purity. Should give no precipitate with nitrate of silver; absence of hydrocyanic and formic acids. A small quantity poured on a little water, and ignited, should leave an aqueous solution, which gives no precipitate with nitrate of silver; absence of hydrochloric ether, chloride of ethylene, &c.

The chloride of calcium test is not of much value. Firstly, because only those samples respond to it which are nearly of the proper strength, and no information is gained as to the composition of those samples, from which nothing separates, except of course that they are below the proper strength. Secondly, because the substance separating though chiefly, is not by any means only, nitrous ether. The iron test may be used as a rough quantitative test by using a sample of known strength for comparison, and it offers a very ready means, before a magistrate for example, to show the character of any impugned sample.

Estimation of Nitrous Ether. Ten cubic centimetres of the ether are introduced into a small flask already containing about 1·5 grammes of solid potash hydrate. The flask is closed with a well-fitting cork, gently agitated from time to time to promote solution of the potash, and left standing over night. Next day the contents of the flask, more or less yellow according to the amount of aldehyde present, are washed into an evaporating basin with 50 c.c. of water, and the mixture evaporated on a water-bath to about half or one-third. The remainder is allowed to cool, filtered through a little glass wool into a beaker made up to 300 c.c. with water, 50 c.c. of diluted sulphuric acid (1 in 4) are added, and the nitrous acid present determined by a standard solution of permanganate. This standard solution is prepared by dissolving 8·475 grammes of pure permanganate of potassium (or its equivalent) in one litre water; 1 c.c. of this solution is equivalent to 0·01 grammes of nitrous ether, and therefore indicates 0·1 per cent. of nitrous ether, if 10 c.c. of ether have been taken. The decolouration of the permanganate is rapid at first, gradually becoming slower. As soon as this is perceived not more than 0·5 c.c. are added at a time, and the process must be considered as at an end if the solution still shows a distinct pink or red colouration two minutes after such addition. For every cubic centimetre of permanganate solution then used, the Spiritus Ætheris Nitrosi contains, at a maximum, 0·1 per cent. of nitrous ether. The solution still continues to decolourise permanganate, though but slowly, and much more will have to be added before the colouration becomes permanent. I have however convinced myself, by many experiments, that all nitrous acid present is oxidised when the above indicated point is reached. No doubt other substances are oxidised as well, and the process indicates more nitrous ether than is actually present; but as the error is on the side of leniency, it is perhaps an advantage rather than otherwise. By following out strictly the directions here given, it will be found that duplicate analyses of a sample rarely differ more than 0·1 per cent. from each other; while, with poor samples, the agreement is even more perfect. Should a sample require much permanganate, and the solution, instead of becoming colourless, remains brown or yellow, more sulphuric acid must be added.

If, instead of evaporating and filtering the alcoholic solution, it is at once diluted, acidified, and permanganate added, more of the latter will be required than in the former case. In good samples the difference is sometimes great, but in most poor samples it is but slight, and in such case this more rapid process may be adopted. I have also tried the process of adding at once an excess of permanganate, letting stand five minutes and estimating the excess remaining, but the results given are decidedly too high. Various other methods have been proposed for the estimation of the nitrous ether, but I do not propose to enter into such, as the process given fulfils, I believe, all necessary conditions.

It is stated in most works on the subject that nitrous ether is rapidly decomposed and becomes acid. The latter statement is correct, as far at least as ordinary Spiritus Ætheris Nitrosi is concerned, but the former is not in accordance with my experience. Spiritus Ætheris Nitrosi becomes acid mainly on account of the oxidation of the aldehyde it contains, while the nitrous ether present suffers but slow decomposition, at least when dissolved in spirit of sufficient strength. The following analyses will illustrate this. Sample I. was prepared by myself on February 21st, 1872, and has been kept ever since in a glass stoppered bottle (white glass) of one litre capacity which it filled about half at first. About one half of the neck of the bottle was broken off early in 1872, so that the stopper does not fit very tightly since. The bottle stood on a shelf in the laboratory exposed to ordinary diffused daylight, but never to direct sunlight. On the bench below, and near to where the bottle stands, a Bunsen gas burner is frequently in use. Sample II. was bought as a sample of Spiritus Ætheris Nitrosi (*Brit. Pharm.*) from a well known wholesale house on December 2nd, 1873. It was contained in the ordinary pint bottle of green glass, and stood ever since in a cupboard of the laboratory, or in other words chiefly in the dark. Both bottles were frequently opened, and small portions of ether taken out in the intervals between the analyses given:—

No. of sample.	Date of examination.	Specific gravity.	Corresponding alcoholic strength.	Total acid free as acetic acid.	Real nitrous ether.
I.	Feb. 21, 1872	·836	84·8 per cent. b. w.	0·10	2·00
,,	Nov. 15, 1873	·839	83·6 ,, ,,	0·90	1·98
,,	April 23, 1879	·844	81·7 ,, ,,	0·85	0·89
II.	Dec. 2, 1873	·824	89·5 ,, ,,	1·19	1·35
,,	April 15, 1879	·847	80·5 ,, ,,	1·38	0·96

We see, therefore, that even under somewhat unfavourable conditions the decomposition of the nitrous ether proceeds but slowly, and the plea sometimes advanced by chemists that the sample of Spiritus Ætheris Nitrosi obtained at their shops, and found wanting, had been kept for some time and had decomposed, may safely be set aside as untrue.

In conclusion, I give the analyses of a number of samples, every one of which was bought as Spiritus Ætheris Nitrosi (*Brit. Pharm.*), and should therefore have had a sp. gr. of 0·845, and contained about 3 per cent. of nitrous ether. All, except the last, were, however, bought before the present Sale of Food and Drugs Act came into operation. The last sample was supplied to the Westminster Hospital early in April, 1879. The bottle containing it, a Winchester quart, was labelled "Spiritus Ætheris Nitrosi, Brit. Pharm., sp. gr. 0·845." The bottle was quite full, and had not been opened at the Hospital, the stopper being still tied over with bladder when I took the sample on April 23rd, 1879.

Specific gravity.	Corresponding alcoholic strength.	Total free acid as acetic acid.	Real nitrous ether.
0·908	54·05 per cent. b. w.	0·42 per cent.	0·23 per cent.
0·913	52·0	0·39	0·19
0·851	79·	0·09	0·06
0·892	61·5	0·32	0·38
0·854	77·7	0·47	0·44
0·936	41·8	0·41	0·10
0·851	79·	1·14	1·30
0·928	45·6	0·33	0·25
0·852	78·5	0·28	0·07
0·848	80·	1·28	1·40
0·849	79·7	0·96	0·52

Mr. Hehner suggested that the direct addition of iodide of potassium would give a much fairer measure of the quantity of nitre present. He would add acetic acid and iodide of potassium, which both Dr. Muter and Mr. Wigner said they thought was a very good idea.

ON THE ESTIMATION OF ETHYL NITRITE IN SPIRITUS ÆTHERIS NITROSI, B.P.

By John Muter, Ph.D., F.C.S.

I have been in the habit of using a saponification process for this spirit, but I work in a manner somewhat different from that used by Dr. Dupré, which I think possesses several advantages. The solutions I use are:—

(1). Decinormal solution of hyposulphite of soda (sodium thiosulphate), made exactly according to the directions of the British Pharmacopœia, each c.c. of which = ·0127 free iodine.

(2). Solution of potassium permanganate, containing 3·175 grammes per litre, and checked to balance the "hypo." solution, by adding excess of saturated solution of potassium iodide to 100 c.c., and then seeing that the iodine set free exactly requires 100 c.c. of "hypo." for complete decolourisation, starch paste being added as an indicator towards the end of the process.

I first take the specific gravity of the sample at 60° Fahr., and I then measure out

10 c.c. of the spirit for analysis. This I digest with sufficient potassium hydrate in a small strong glass flask, closed by a cork, through which passes a bent delivery tube, dipping under a column of mercury in a test tube, of such a height as will enable me to heat gently on a water-bath under pressure without bursting the flask. This point is ascertained by a blank experiment, during which the flask is wrapped in a cover to prevent accident; and once arrived at, the same flask and mercury column are always employed. After digestion under pressure with frequent agitation for some time (an hour being usually ample), water is added, and the contents of the flask evaporated in a basin until no smell of spirit is perceptible. The residual liquid having been rendered *just neutral* with sulphuric acid, is filtered into a flask containing 75 c.c. of permanganate solution, previously diluted to 200 c.c. with water and acidulated with 20 c.c. dilute sulphuric acid (1 in 3), and the flask having been corked is left for half an hour. At the end of that time excess of saturated solution of potassium iodide is added (which should produce a clear deep orange solution), and the whole brought under a burette containing the hyposulphite solution and titrated. The number of c.c. of "hypo." used is deducted from the number of c.c. of permanganate put in, and the difference multiplied by ·00375 gives the amount of ethyl nitrite in the 10 c.c. taken for analysis, and if this be multiplied by 100 and divided by 10 times the specific gravity of the original spirit, the answer will be the percentage of ethyl nitrite by weight. In working with spirits of unknown strength it is advisable to put only 20 c.c. of permanganate into the flask at first, diluted and acidulated as directed, and then if all the colour disappears under five minutes, to add 5 c.c. more at a time, until a permanent colour is obtained, lasting five minutes, when the addition of another 5 c.c. will suffice before setting aside for the half hour. In a good spirit it is sufficient to take 5 c.c. for analysis, and to use 35 to 38 c.c. permanganate.

I am the more inclined to believe in the accuracy of this method, because I have found, by experiment, that the action of potassium nitrite on permanganate is not thoroughly trustworthy under half an hour. Ethyl nitrite is, however, much more rapidly affected, and I am at present engaged on a process whereby saponification is entirely avoided, and the whole thing does not occupy more than ten minutes. Until I publish this, I reserve my results on the actual constitution of the spirit, and the loss it undergoes by keeping. I am not at all clear that we should depend entirely on the ethyl nitrite alone for the real value of this medicine, and my other method depends on the estimation of the aldehyd and other bodies present in the article when properly made according to the official process.

The following are some analyses of pure spirits (specially made for me by Mr. Phillips—of Messrs. Knowles and Phillips—strictly by the B.P. process, and answering the gravity and separation tests of that authority), which were recently performed by one of my advanced students, Mr. Luther Scammell:—

Sample No. 1 contained 3·05 ethyl nitrite
" " 2 " 2·91 " "
" " 3 " 2·96 " "
" " 4 " 2·35 " "
" " 5 " 2·89 " "
" " 6 " 2·93 " "

I always prefer prefer to do a blank experiment, using 20 c.c. pure rectified spirit, and the same weight of potassium hydrate as I use to the ether, and check it side by side with the sample experiment. In practice I use about two grammes KHO and add 10 c.c. of rectified spirit, which aids its solution and helps saponification of the ethyl nitrite. I have also often used, for the saponification, a small flask fitted to a well cooled upright condenser, and worked at the boiling point; but I find the simple arrangement above stated does just as well.

ANALYSES OF FLOURS AND BREADS.

By J. Carter Bell, F.C.S.

Read before the Society of Public Analysts, on 4th June, 1879.

Since December, 1877, I have been engaged upon the analyses of flour and bread, with the object of satisfying myself, by actual experiment, as to the quantity of phosphate of alumina contained in those two essential articles of food. Like many other chemists I was under the impression that the quantity of alum calculated from the phosphate of alumina found in a four-pound loaf was very small, but since I have analysed over one hundred samples, my views have been considerably modified. It is with diffidence I bring these analyses forward, as the Institute of Chemistry seems completely to ignore the original work of Public Analysts, and is groping hopelessly in the dark; whereas, if some guidance were accepted from men who have had practical experience, the Institute might gain some information upon the analysis of food, of which it confesses itself at the present time ignorant. In the Conference upon Milk no mention was made of the labours of Mr. Wanklyn, myself and others. In my experiments upon milk, I had 183 cows milked in my presence at various times and seasons; the milk from the majority of these cows was analysed separately, and all information, such as food, age, colour of cow, &c., was obtained, so that accurate data could be registered for fixing a milk standard, which I flatter myself I have obtained, and now decide according to that standard. It may be that this quiet ignoring of work accomplished, may arise from a modest desire of the Institute that men should not labour and the Institute enter into their labours.

In the following analyses, which for the above reasons I forward to the Society of Public Analysts, I have been careful to obtain samples of flour and bread of acknowledged purity. Many of the samples of flour were obtained from Mr. Render, of the Crown Flour Mills, Salford, and of Mr. Moss, of West Gore Street Mill, Salford; they, knowing what I required the samples for, were most careful in supplying them as pure as they could possibly be. My method of analysis was that proposed by Dr. Dupré, and modified by Mr. Wanklyn. Before incinerating flour or bread, I always thoroughly dry the samples, as I find they burn away in a much shorter period, and no unpleasant vapours are evolved.

Much has been said and written about the logwood test and its uncertainty, but according to my experience, if the solution is prepared according to the directions given r. Horsley, it works admirably. I take 16 grammes of freshly-cut logwood, and digest in cold methylated spirit for about eight hours, with an occasional shake of the solution ; at the end of the eight hours the clear liquor is poured off.

For bread, about 10 grammes of the crumb are taken, and a mixture consisting of 90 c.c. of water, 5 c.c. of the logwood solution, and 5 c.c. of a saturated solution of carbonate of ammonia is poured over the bread in a porcelain dish. If the bread contains alum, a dark lavender blue soon makes its appearance. The bread is washed and dried ; if the blue lavender colour remains, I always find that alum is present. For flour, I weigh out 10 grammes, mix with 10 c.c. of water, then add 1 c.c. of logwood solution, and 1 c.c. of carbonate of ammonia solution ; if the flour is pure, a pinkish colour is obtained ; whereas, if alum is present, the pink is changed to lavender, and I have detected alum in flour in so small a quantity as 3 grains to the four-pound loaf. By having a standard solution of alum and adding it to flour, it will be at once seen whether the logwood solution is fit to use. I have had mine made up for several months, and it is still good. Until I read Dr. Dupré's paper, I had not paid much attention to the silica in flour and bread ; but I now see that it forms a very important item in the analysis, because whenever I obtained a high silica, I looked for a high phosphate of alumina. In all cases of flour and bread ; I have calculated the silica and alum in grains to the four-pound loaf.

The first lot of five flours I obtained from Mr. Render, in 1877. The crown is the trade mark of the firm ; five crowns being the best flour, and made from the centre of the grain of the choicest wheats, while the lower crowns are of inferior quality. Thus, the price of five crowns is 48s. a sack, while one crown is 34s. ; the intermediate ones are between the two extremes. These flours were made from a mixture of English and Californian wheats. No. 2 crown has a very high phosphate of alumina, equalling about 16 grains of alum to the four-pound loaf. I thought that there must be some mistake as regards this flour, which led me to make further experiments. The flour was analysed four times, with the following results :—

			Grains of Silica to 4 lb. loaf.	Grains of Alum to 4 lb. loaf.
No. 1	Silica ·100	Phosphate of alumina ·021	21	15¾
2	,, ·102	,, ·017	21¼	12¾
3	,, ·105	,, ·020	22	15
4	,, ·109	,, ·024	22¾	18

These results do not agree so well as could be wished, owing, I expect, to the mechanical mixture. I cannot believe that this amount of alumina is a constituent part of the grain, but must arise from imperfectly cleaned wheat. The large percentage of silica is an important item to be noticed in the analysis; any chemist using moderate care could not return this flour as adulterated with alum. Five pounds of the flour were made into bread. The analysis of the bread crumb gave :—

Moisture	45·000 per cent.
Silica	·066 ,,
Phosphate of iron	·007 ,,
Phosphate of alumina	·011, or 11¼ grains alum to the 4 lb. loaf.

It is my practice in bread analysis, to deduct 10 grains of alum from the total quantity calculated from the phosphate of alumina found in a four-pound loaf. So that on the above bread, when the ten grains are deducted, the quantity left would be so small, that taking notice of the high silica, this bread could not be returned as containing alum. Out of the one hundred samples I have examined, this is the only instance of a loaf which contains 11 grains of alum.

Two other flours—one marked Russian, and the other Ghirka—gave high alumina, but at the same time high silica : these were coarse flours, such as a good baker would not like to use.

The analyses of these were as follows :—

	100 parts contain	
	Russian.	Ghirka.
Moisture	13·86	8·280
Ash	·58	·592
Silica	·055	·062
Phosphate of iron	·007	·007
Phosphate of alumina	·016	·016

2¾ lbs. of this Russian flour were made into bread ; it made a very coarse brown loaf, and the analysis was as follows :—

Moisture	42·700
Silica	·034
Phosphate of iron	·006
Phosphate of alumina	·010 or 10 grains to 4 lb. loaf.

Here, again, the deduction of the 10 grains leaves nothing to return as alum. These I consider extreme cases : for it will be seen by the great number of samples of bread which I have bought from shops in Salford, not one reaches 10 grains of alum to the four-pound loaf.

Some of the flours in the following list require a little explanation. No. 1 Crown has a high silica ; this analysis was made in 1877, but while writing this paper I have estimated the silica again, and the mean of the two gives ·077. No. 2 I have already explained. I have tried to obtain some more of the same kind of flour but have not succeeded. In June, 1877, I analysed another sample of 2 Crown Flour—

Silica	·009
Phosphate of iron	·003
Phosphate of alumina	·008

In March, 1879, another lot of 2 Crown gave—

Silica	·021
Phosphate of iron	·004
Phosphate of alumina	·010

From these, and other samples, I am inclined to believe that the sample of 1877 was an exceptionable one. I have found that fine flours are less likely to contain high silicas and aluminas when they have been prepared by what is called the " high grind process :" by this a central portion called " extract " is taken from the wheat, by the millstones being kept further apart than by the old process of grinding; thus leaving a large amount of flour adhering to the bran, which being again re-ground gives a poor flour called " bran flour," which is liable to contain more alumina than the extract flour, in consequence of being subject to a more severe treatment between the stones.

Between the " extract " and the bran flour there are several intermediate qualities of semolina flour, from which some of the choicest flours now in use are produced.

The American spring wheat has a high silica, ·054; this was estimated in 1877. Within the last few days the analysis has been repeated, with the same results.

Residue Flour is called in the trade "inferior re-grounds."

Bran Flour. This is flour that lies closest to the skin, which has been removed by second grinding, and only produced by the high grind process.

Exhaust Flour. This is flour drawn from the stones by the draught which keeps the stones cool. It is liable to contain a larger quantity of alumina than found in ordinary flour.

No. 18.—From a country mill in Cheshire.

Nos. 19, 20, 21.—Made in Salford by Mr. Moss, by the old process of grinding.

Nos. 26, 27.—Bought from bakers, in Salford.

	100 parts contain						
	Moisture.	Ash.	Silica.	Phosphate of Iron.	Phosphate of Alumina.	Grains of Silica to 4 lb. loaf.	Grains of Alum to 4 lb. loaf.
1. One Crown Flour	13·02	·628	·077	·0107	·018	16¼	13½
2. Two " "	12·62	·604	·105	·0056	·0204	22	16
3. Three " "	12·46	·52	·024	·003	·009	5	7
4. Four " "	9·84	·448	·015	·005	·007	5	5½
5. Five " "	12·08	·488	·012	·003	·005	2½	4
6. White English Wheat, 1877	11·82	·484	·010	.002	·004	2	3
7. Red " "	13·62	·438	·020	·004	·010	4¼	7¾
8. American Spring Wheat	12·62	·492	·056	·006	·013	11¾	10
9. " Red Winter Wheat	13·06	·380	·014	·002	·007	3	5½
10. Empress Hungarian	11·44	·368	·010	·001	·002	2	1½
11. Residue Flour, from 1, 2, 3 mixture of Crown ..	9·48	·476	·028	·010	·010	5¾	7¾
12. Bran Flour	8·92	·488	·029	·009	·012	6	9½
13. Exhaust Flour	11·35	·610	·0268	·0058	·011	5½	8½
14. Russian Flour	13·86	·580	·055	·0072	·0162	11½	12½
15. Egyptian "	12·98	·700	·020	·0045	·0059	4¼	4½
16. Ghirka "	8·28	·592	·062	·0067	·0163	13	12½
17. Semolina "	7·02	·410	·011	·0008	·0062	2¼	4½
18. Flour, English and foreign wheat, ⅖ English, ⅗ foreign; the foreign principally Californian	12·00	·400	·020	·001	·001	4¼	¾
19. Straws, made in Salford	13·22	·672	·010	·0021	·0023	2	1¾
20. Coarse Flour, or seconds, containing bran ..	13·92	1·44	·052	·0032	·0058	11	4½
21. White Flour, made in Salford	13·02	·680	·023	·0032	·0018	5	1½
22. Peerless Flour, made by Banaman, Sherman and Co., Rochester, U.S.	13·30	·500	·011	·00025	·001	2½	¾
23. Gilt Edge, made by Chase, Bristol and Bide, Rochester, U.S.	13·01	·516	·020	·00027	·0008	4¼	½
24. Californian Flour	12·60	·480	·021	·0064	·0078	4½	6¼
25. White English, 1878	14·90	·368	·021	·0035	·0049	4½	8¾
26.				·0005	·0015		1
27.	12·80		·0335	·004	·009	7	7
28. Two Crown Flour, total produce of wheat—40 per cent. Red English, 30 per cent. Californian White, 30 per cent. Canadian White ..	12·80	·260	·023	·0037	·0087	4¾	6¾
29. Bran Flour from Two Crown Mixture	12·30	·76	·046	·007	·016	9½	12½
30. Two Crown Flour, less 5 per cent. Bran Flour ..	13·00	·26	·0214	·004	·0106	4½	8¼
31. P. A. Campbell, San Francisco	12·200	·300	·016	·003	·004	3¼	3
32. J. F., Salem Mills, United States..	10·320	·448	·012	·004	·004	2½	3
33. Albany City Mills, United States..	10·000	·520	·013	·002	·001	2¾	¾

The following thirty-two breads were bought from bakers in Salford, and the crumb of the bread was taken for analysis—

		Moisture.	Silica.	Phosphate of Iron.	Phosphate of Alumina.	Grains of Silica to 4 lb. loaf.	Grains of Alum to 4 lb. loaf.
1.	Bread	46·10	·014	·0010	·0030	3	3
2.	,, ...	45·00	·033	·0013	·0067	7	6½
3.	,, ...	45·50	·019	·0013	·0037	4	3½
4.	,, ...	40·30	·010	·0013	·0022	2	2
5.	,, ...	40·50	·012	·0010	·0030	2½	3
6.	,, ...	46·00	·015	·0013	·0046	3	4½
7.	,, ...	44·50	·017	·0016	·0034	3½	3¼
8.	,, ...	46·00	·014	·0018	·0082	3	8
9.	,, ...	46·00	·013	·0010	·0040	3¾	4
10.	,, ...	45·50	·039	·0029	·0031	8¼	3
11.	,, ...	46·50	·014	·0013	·0052	3	5
12.	,, ...	46·00	·018	·0010	·0050	3¾	5
13.	,, ...	46·00	·037	·0013	·0057	7¾	5½
14.	,, ...	46·00	·021	·0026	·0026	4½	2½
15.	,, ...	46·20	·013	·0032	·0028	2¾	2¾
16.	,, ...	47·50	·019	·0005	·0045	4	4½
17.	,, ...	46·50	·012	·0013	·0043	2½	4¼
18.	,, ...	49·50	·016	·0018	·0032	3¼	3
19.	,, ...	47·50	·021	·0016	·0064	4½	6¼
20.	,, ...	46·50	·016	·0018	·0037	3¼	3½
21.	,, ...	47·20	·029	·0018	·0042	6	4
22.	,, ...	46·50	·0205	·0018	·0068	4¼	6¾
23.	,, ...	45·50	·024	·0018	·0064	5	6¼
24.	,, ...	46·00	·015	·0026	·0066	3	6½
25.	,, ...	45·30	·015	·0040	·0052	3	5
26.	,, ...	46·20	·019	·0032	·0044	4	4¼
27.	,, ...	44·50	·019	·0040	·0038	4	3¾
28.	,, ...	44·00	·020	·0026	·0058	4¼	5¾
29.	,, ...	45·50	·012	·0016	·0044	2½	4¼
30.	,, ...	44·50	·019	·0018	·0048	4	4¾
31.	,, ...	44·00	·017	·0026	·0042	3½	4
32.	,, ...	46·00	·025	·0018	·0058	5¼	5¾

The following eight breads were made under my own superintendence from flour which I had analysed, and which appear in the table :—

100 parts contain

	Moisture.	Silica.	Phosphate of Iron.	Phosphate of Alumina.	Grains of Silica to 4 lb. loaf.	Grains of Alum to 4 lb. loaf.
Bread made from One Crown Flour	45·00	·051	.001	·003	10¾	3
,, ,, Two ,, ...	45·00	·065	·0067	.011	13½	11
,, ,, Three ,, ...	40·00	·019	·0026	·009	4	9
,, ,, Four ,, ...	38·00	·016	·005	·004	3¼	4
,, ,, Five ,, ...	36·50	·013	·0045	·0022	2¾	2
,, ,, White English Wheat ..	36·90	·015	·003	·004	3	4
,, ,, Red ,, ..	39·50	·020	·0021	·0053	4¼	5¼
,, ,, Russian Flour	42·70	·034	·010	·0053	7	5¼

These breads were made by Mr. Render, from samples of flour ground by himself. The bread in most cases was tried with logwood, but gave no indications of alum.

Bread 50 per cent. English Red, 50 per cent. Canadian White	42·50	·019	·0032	·0082	4	8
,, Pure White Canadian	42·50	·021	·0018	·0035	4½	3½
,, Canadian Semolina	43·90	·008	·0026	·0032	1½	3¼
,, 50 per cent. English Red, 50 per cent. Semolina	43·00	·015	·0026	·009	3	9
,, Californian Flour	43·50	·023	·0072	·0100	4¾	10
,, One Crown Flour	46·50	·019	·0035	·0031	4	8
,, Four ,, ...	45·00	·008	·0053	·0053	1½	5¼

The following are some instances of pure samples of bread, which when treated with the logwood solution gave a very suspicious blue colour when wet, and caused me to think that alum was present, but after washing and drying the sample there was not the slightest trace of blue colour; and I should strongly urge all analysts to dry the samples of bread before giving a decided judgment upon the presence or absence of alum. It is now my habit to enter in a note-book my opinion as regards a sample of bread when treated with the logwood solution before taking further steps, to show how easily one may be deceived by giving a verdict without trying the logwood test. I had two samples of bread from the County of Chester, a few days since. The logwood test was applied as usual. I entered—" The bread has a bluish colour, and I should think there will be about 8 grains of alum to the four-pound loaf."

The analyses of the samples were—

48·1	·008	·002	·006	1½	6
47·5	·012	·004	·004	2½	4

When the bread was dry there was no blue colour.

The following are some samples which I have analysed, thinking from the logwood test that they contained alum; if I had waited until the logwood bread was dry, I should then have seen that I had been mistaken, but having begun the analysis I thought it would be interesting to finish. I have arranged them in order of the silicas.

Silica.	Phosphate of Iron.	Phosphate of Alumina.	Grains o fSilica to 4 lb. loaf.	Grains of Alum to 4 lb. loaf.
·008	·002	·005	2¼	5
·012	·004	·004	3¼	4
·018	·003	·005	5	5
·020	·004	·003	5½	3
·023	·005	·010	6	10
·027	·006	·010	7½	10
·031	·004	·009	8½	9
·031	·006	·010	8½	10
·031	·004	·009	8½	9
·039	·003	·008	11	8
Bread containing alum—				
·008	·003	·026	2¼	26
·015	·004	·025	4¼	25
·016	·004	·034	4½	34
·017	·003	·037	4¾	37
·020	·004	·040	5½	40
·020	·005	·024	5½	24
·022	·003	·026	6	26
·029	·003	·041	8¼	41
·030	·005	·037	8½	37
·030	·005	·028	8½	28
·033	·004	·015	9¼	15
·037	·004	·021	10¼	21
·040	·005	·032	11¼	32
·041	·004	·015	11½	15
·041	·008	·013	11½	13
·046	·003	·020	12¾	20

I thought it would be interesting to trace the alumina from the wheat, through the various products. I therefore procured some wheat from Mr. Render, and he prepared the bran, flour, &c., specially for me.

Contained in 100 parts

	Moisture.	Ash.	Silica.	Phosphate of Iron.	Phosphate of Alumina.	Grains of Silica to 4 lb. loaf.	Grains of Alum to 4 lb. loaf.
English Wheat grown upon chalk soil *	9·512	1·720		·004	·013		10
Bran, 18½ per cent.	12·400	5·640	·206	·046	·016	48¼	12½
Sharps, 8½ ,,	12·720	2·000	·034	·007	·017	7	12¾
One Crown Flour, 26 per cent.	13·20	·500	·008	·003	·007	1¾	5½
Four ,, 45 ,,	13·28	·368	·011	·002	·006	2¼	4½

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* The sample of wheat had been lying in the miller's office for some days. This will account for the low moisture.

Mr. Penney, on page 80 of the *Chemical News* for this year, states—"It has recently become apparent that the attempt to fix upon a standard must be abandoned." My labours, which have extended over fifteen months, during which time I have examined nearly two hundred samples, lead me to a more hopeful conclusion, and appear to prove that a standard can be fixed; and a chemist with common judgment ought to be able to determine whether any excess of alumina is due to adulteration, or to other causes. It may please the public to know that out of many hundred samples I have only found one case of *flour* adulterated with alum.

Dr. Dupré said he found the logwood often gave a re-action, but the colour disappeared when drying; he was in the habit of drying in an air-bath, and that he believed was the original direction when this test was first brought prominently forward. Not unfrequently flours might give a suspicion, but dry them and it disappears at once. One point in Mr. Bell's paper struck him as being of value, viz., that the bran in flour should be estimated, and if possible the bran in the bread, because bran contains a large amount of silica and very little alumina. He had just had nine samples of bread to analyse. One gave the logwood reaction and contained alumina equivalent to 42 grains of alum per 4 lbs.—the silica came to 17 grains per 4 lbs.—so that he reported it to be adulterated with about 24 grains of alum.

Dr. Muter said that, with reference to the elucidation of the silicate question by ascertaining the amount of bran present in the flour, he should propose an attempt at the estimation of the cellulose, by a rapid process such as he had tried some years ago on a drug containing only a minute quantity, and which consisted in finding the amount soluble in ammoniacal cupric oxide solution. He prepared some of the re-agent of which he took two equal parts by weight, and placed them side by side; into one he put the impure cellulose to be estimated, and, after proper maceration, he filtered both fluids through equal weights of a mineral filtering medium, and then evaporated both and dried at the same temperature, and for the same time. The increase in the one residue over the other was supposed to be cellulose; and his impression was that the process promised well, but he intended to try it again on this flour question at his first spare time. Mr. Bell had noticed a fact about the logwood test which was quite correct; namely, that a colour sometimes appears while wet, but disappears on drying. In such cases he had noticed that there was usually sufficient alumina to calculate to about 12 grains alum per loaf, and an excess of silica such as to prevent its being considered to be really alum. He remembered that in the cellulose process he spoke of, much depended upon the temperature at which the maceration was done, but the exact particulars he had now forgotten.

ON DR. KOETTSTORFER'S METHOD FOR THE EXAMINATION OF BUTTER FOR FOREIGN FATS.

By G. W. Wigner, F.C.S.

Since the publication of this process in the Analyst last month, I have carefully tested it on various samples of genuine butter and of adulterated butters, and other fats, such as dripping or lard, and find it not only a quick and handy process, but a reliable one.

The point of neutrality is very sharply indicated by the phenol-phtalein, and by working on moderate quantities, say 50 grains, or thereabouts, of the filtered fat it is possible to obtain a much greater relative degree of accuracy than by the determination of the fatty acids.

I find it advisable, after saponification, to dissolve the soap in hot water and titrate while still hot; by this means the precipitation of the fatty acids during the process of titration is prevented, and the finish of the neutralization seen more distinctly.

I find that my samples of butter require a slightly larger percentage of potash to saturate them than the samples investigated by the author of the process, but the difference is small, and there is about 8·0 per cent. difference between the potash required by any fat I have yet tested, and that required by a genuine sample of butter.

SALE OF FOOD AND DRUGS ACT AMENDMENT BILL.

This Bill, a copy of which appeared in our last number, has passed the House of Commons, and is now before the House of Lords. The Commons have amended the last clause by limiting the provision for serving a summons within 28 days from the time of the purchase of an adulterated article, to "the case of a perishable article" only, and the following new clauses have been introduced:—

"Any medical officer of health, inspector of nuisances, or inspector of weights and measures, or any inspector of a market, or any police constable under the direction and at the cost of the local authority appointing such officer, inspector, or constable, or charged with the execution of this Act, may procure at the place of delivery any sample of any milk in course of delivery to the purchaser or consignee in pursuance of any contract for the sale to such purchaser or consignee of such milk; and such officer, inspector, or constable, if he suspect the same to have been sold contrary to any of the provisions of the principal Act, shall submit the same to be analysed, and the same shall be analysed, and proceedings shall be taken, and penalties on conviction be enforced in like manner in all respects as if such officer, inspector, or constable had purchased the same from the seller or consignor under section thirteen of the principal Act.

"The seller or consignor or any person or persons entrusted by him for the time being with the charge of such milk, if he shall refuse to allow such officer, inspector, or constable to take the quantity which such officer, inspector, or constable shall require for the purpose of analysis, shall be liable to a penalty not exceeding ten pounds."

Analyses at a Discount.—At the Breconshire Quarter Sessions, a letter was read from the Local Government Board, referring to the county having made no arrangements for obtaining samples for analysis by the Public Analyst under the Sale of Food Act, and requesting that the provisions of the section of the Act bearing upon the point might be brought before the Court. Sir Joseph Bailey asked what expense it was to the county, and what good it was. Mr. Lloyd said the analyst was paid by the year, and not by the case. Sir Joseph observed that they were perfectly content with their food and drugs. The report of the County Analyst was read as follows:—"I have the honour to report that I have not received during the past quarter any sample of food, drink, or drugs." The Chief Constable was requested to take a number of cases, and ascertain what was the amount of remuneration.

Declining to appoint an Analyst.—At a recent meeting of the Leominster Town Council a letter was read from the Local Government Board, calling attention to the fact that they had already sent two communications, asking if the Council had further considered the subject of the appointment of an analyst for the Borough, and if so, the Board wished to be informed of the result. It was stated that the Local Government Board had been pressing this matter on the Council for nearly two years. Mr. Sale said he presumed the Council would send back the stereotyped reply—that they had not appointed an analyst yet. This was agreed to by the Council, and Dr. Pentland remarked that if it should be necessary to have an analysis made under the provisions of the Sale of Food Act, such analysis would be easily procurable from the Public Analyst of Worcestershire or other adjoining counties.

REVIEWS.

A Manual of Organic Chemistry, Practical and Theoretical, for Colleges and Schools. By Hugh Clements. London: Blackie & Son, 1879.

This work, despite its somewhat ambitious title, is a small volume of some 280 pages. A large portion of it is stated to be a reprint from serial papers which have appeared in the *English Mechanic* and *World of Science*, and it is put forward with the object of forming a " text book " for candidates preparing for examination.

There is one chapter on the " Identification of Organic Substances," which, in its general design and style, is original, and likely to prove useful to a student. This chapter extends to some 46 pages, and the author has evidently taken some pains to make it worthy of reference; and, notwithstanding some curious and unfortunate errors which occur, he has, on the whole, succeeded. A more systematic arrangement would, however, have improved it.

The chapter on "Oils" would be useful for reference, if the errors, which are scattered through it, were weeded from it. Thus, we are told that linseed contains 20 per cent. of fat, and a few pages further the maximum limit is fixed at 27 per cent.

But, having noticed these two chapters, we cannot give a single word of praise to the remainder of the book. Its evident object is to serve as a " crib," and enable a student to successfully pass an examination without having really acquired the knowledge which the examination was meant to test.

Nearly 90 pages are occupied with what professes to be a reprint of the papers set in Organic Chemistry at the Science and Art May Examinations for the last eleven years, with the correct answers or references to that part of the volume in which they may be found. It is obvious that the use of such a " key " as this must be attended with both chemical and moral injury to the student, and must compel the examiners to take far greater heed of the results of practical work than of the replies to questions which may be learned by rote.

Another chapter consists of a series of so-called exercises, which are simply a series of questions, some being of the most puerile kind, such as " What organic substances taste acid ? " " sweet ? " " bitter ? " " peculiar ? " while in others the student is requested to make a qualitative analysis of the following " *mixtures*," among which appear beef, mutton, blood, oranges, urine, coal gas, ink, &c.

We fear that Mr. Clements' loose mode of expression is not calculated to foster habits of accuracy in those who take his book as a guide.

An Introduction to Pharmaceutical and Medical Chemistry (Theoretical and Descriptive). By Dr. John Muter, F.C.S.

An Introduction to Analytical Chemistry (for Pharmaceutical and Medical Students). By the same author. London: Simpkin & Marshall, and Baillière, Tindall & Cox.

These two volumes constitute the second edition of the author's *Pharmaceutical Chemistry*, which has been thus divided, owing to its bulky proportions, into a book for the laboratory and one for home study. The organic portion has been somewhat extended, but otherwise the whole work retains its original scheme of teaching the salts under their respective acidulous radicals instead of following the usual metallic arrangement. The practical volume contains *inter alia* a new course for the third group in the presence of phosphoric acid. Criticism at our hands is manifestly impossible.

Skeleton Notes on Analytical Chemistry. By A. J. BERNAYS. London: Churchill, 1879.

THESE skeleton notes are extracted from the fifth edition of Dr. Bernay's *Notes for Students in Chemistry*. They form a small and handy volume of about 50 pages. The author has not adopted the tabular form, but presents all the information in ordinary letterpress. The arrangement of the book is good, and by the careful use of four different types reference is very greatly facilitated. It is specially designed for the use of medical students, but those who are carrying the study of chemistry far beyond the simple requirements of the College of Surgeons, will find it not only a useful pocket companion but reliable for its accuracy.

Nitric Nitrogen in Guano.

MR. R. R. TATLOCK has communicated a paper on the above subject to the Newcastle Chemical Society. He points out that by the soda lime process a large portion of the nitrogen, which exists in guanos in the form of nitrates, is transformed into ammonia during the combustion, and a considerable error therefore introduced into the analysis. As many natural guanos contain 1 to 2 per cent. of nitrates the error is important even in reference to them, but becomes much more so when guano has been adulterated with nitrate of soda; since, if a separate determination of the nitrates is made, and no allowance made for the quantity obtained as ammonia, a purchaser would virtually be called upon to pay for the nitric nitrogen twice over.

The author has made a number of experimental soda lime combustions, in which small known quantities of nitrate of potash were intimately mixed with known organic substances such as starch, albumen, sugar, &c., and then burnt. From these experiments he draws the following conclusions:—

1. That using 3 of organic matter (starch) to 1 of nitrate, 45·30 per cent. of the nitric nitrogen can be obtained.

2. That in no case was the whole of the nitric nitrogen converted into ammonia, the greatest proportion being 97·40 per cent.

3. That the results are somewhat variable, even with the same proportion of the ingredients, something always depending on the completeness with which the mixture is made.

The author reviews the different methods used for determining Nitric Nitrogen in Guanos, and expresses a strong opinion in favour of Crums' process, since the results are not affected by the organic matter. He points out, however, the desirability of testing the liberated gas by a warm solution of iron sulphate to prove that it is entirely nitric oxide.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

TO THE EDITOR OF "THE ANALYST."

SIR,—The following is the result of an analysis of a cream supposed to have been tampered with, as it did not churn properly :—

Fat	37·76 (with free lactic acid).
Solids, not fat	11·41 of which 1·183 is common salt.
	49·17

I was unable to find any foreign substance whatever, either organic or inorganic, with the exception of the salt. The cream had commenced to turn sour, but had no rancid smell.

I have heard before of cream refusing to churn without an enormous amount of labour, when there has been no suspicion of foul play. Is there any explanation of this phenomenon?

I am, &c.,

RUGBY. A. PERCY SMITH.

TO THE EDITOR OF "THE ANALYST."

SIR,—Our object in writing to you in the first instance was to prevent misunderstanding, which might arise from this statement in Dr. Dupré's paper, viz.: that after our successful appeal at Salford, a second conviction had taken place before a magistrate (referring to a case at Lambeth), against which no appeal had been made. So we wrote to say that the conviction did not refer to the "Steamer over a Globe" Violet Powder, and that since then the same magistrate had practically reversed his former adverse decision, by a subsequent one in the case of a similar charge, made against our "Steamer over a Globe" Violet Powder, which he dismissed.

We decline to enter into any controversy concerning the fallacies and erroneous conclusions contained in Dr. Dupré's paper, as the bulk of it is a mere repetition of the charges made at the Salford Quarter Sessions Appeal; which a full bench of magistrates, presided over by a distinguished Queen's Counsel, declined to believe, after hearing the evidence of our witnesses, headed by the most eminent Public Analyst in the kingdom, supported by other Public Analysts, and also by Physicians and Surgeons of much distinction.

Though Dr. Dupré very condescendingly professes himself not averse to learn from us, it is no part of our business to teach him that which he should already know, viz., the reasons why the authorities at Hyde, Salford, Ashburton, Tiverton, Oakmere, Frodsham, and Lambeth have one and all refused to credit these fancy charges against the use of selenite in violet powder. It is quite sufficient for us, that all these impartial and highly educated gentlemen of position, after hearing every adverse statement carefully set forth by our opponents, should invariably have considered the weight of evidence upon our side and dismissed all the cases. Yours, &c.,

THE MANUFACTURERS OF THE "STEAMER OVER A GLOBE" VIOLET POWDER.

[We print this letter strictly on the principle of *audi alteram partem*, but as it gives no real experimental answer to Dr. Dupré's conclusions, the discussion must now close so far as we are concerned.—EDS. ANALYST.]

ANALYSTS' REPORTS.

Mr. C. Estcourt, Public Analyst for Manchester, in his quarterly report presented to the Council, stated that during the quarter ending March 31st there had been analysed twelve samples of milk, nine of bread, seven of claret, six of port wine, two of tea, and one of sugar. The total number of samples analysed was thirty-seven, and one only was found to be adulterated, viz., a sample of bread, which was found to contain seventeen grains of alum to the 4-lb. loaf. The analyst added that it was very gratifying to observe that a great improvement had taken place in the quality of the milk supply. The report was adopted.

Mr. W. W. Stoddart, Public Analyst for Bristol, in his quarterly report to the Town Council, stated that during the past quarter he had received eighty-three samples—fifty-nine from the inspector, and twenty-four from the public. Six samples of butter were good, and six samples each of flour and lard were genuine. Of the wine samples submitted for analysis all were unadulterated.

Mr. A. J. Edger, Analyst for the County of Durham, during the quarter ending March, examined 144 samples of food, drink, and drugs, and found 60 adulterated. The latter included 15 samples of milk, 20 of sweet spirits of nitre, 2 of tincture of rhubarb, 13 of cream of tartar, 3 of mustard, and 7 of whisky.

LAW REPORTS.

Adulterated Cream of Tartar.—Six tradesmen of West Hartlepool were recently brought before a full bench of magistrates for selling adulterated cream of tartar. The superintendent of police had obtained a certificate from the County Analyst in each case, and these certificates gave the following results :—William M'Cabe, Lynn Street—tartrate of lime, 8·29 ; sulphate of baryta, 0·50 ; sand, 1·20 ; total, 9·99. John Livingston, Church Street—tartrate of lime, 8·4. Wm. S. Rutter, Lynn Street—tartrate of lime, 7·75. Francis Smith, Durham Street—tartrate of lime, 6·61 ; sand, 0·25. Robert Embleton, Stockton Street—tartrate of lime, 6·81. Thomas Layburn, Belle Vue—tartrate of lime, 7·75. M'Cabe's case was taken as a test case ; and in his certificate the Analyst observed that "commercial cream of tartar generally contains a small quantity of tartrate of lime ;" and in M'Cabe's sample it was "present in excess." Mr. Simpson, who appeared as the advocate of all the parties, submitted that the circumstances did not call for a conviction. The article was of the kind demanded by the purchaser, and it was impossible to keep it free from tartrate of lime. The Chairman, after some deliberation, said the article might be considered commercially pure ; and as these were the first cases of the kind before them the bench were not disposed to convict. They, however, recommended tradesmen, for their own protection, to take a guarantee from the wholesale merchant. Nor must the present decision be cited some weeks hence as a precedent. The whole of the cases were accordingly dismissed.

Adulterated Lunch Buns.—At the Salford Police-court, James Bradshawe, confectioner, 412, Regent Road, appeared in answer to the summons charging him with having sold buns which were not of the nature, substance, and quality demanded. Mr. Walker, assistant to the Town Clerk, prosecuted. Mr. Thompstone, the inspector under the Act, said that on the 18th April he visited the defendant's shop in Regent Road, and asked for seven lunch buns. He explained that he purchased them for the purpose of their being analysed, and divided each bun into three parts. The analyst received the samples from witness the same day, and being informed that they were adulterated, witness called at the defendant's shop on the 30th April, and told him that the buns had been found impure. The defendant said that the buns were supplied by Mr. Casson, of Swan Street, Manchester. Mr. J. Carter Bell, the Public Analyst for the Borough, said he received the samples of buns in question from the last witness. He analysed them, and found them to contain alum to the amount of fifty grains in the 4lb. loaf. It was a very large quantity, and that was the amount he declared it to contain after making full reductions. The weight of each bun was about two ounces. Witness considered the buns very indigestible. The defendant now said that he purchased the goods from Mr. Casson, and brought them to his shop ; that was all he knew about them. Mr. Makinson : Could you detect alum in by the taste of the buns? Mr. Bell : No, the alum undergoes a change when mixed with the dough. Mr. Makinson, addressing the defendant, said the Act, as no doubt the defendant was aware, made the seller of the adulterated article liable himself ; but he thought the character of the evidence was very different when the selling was by the person who made the bread. It was, however, the duty of the seller to see that he got articles of a good quality, and he could not be altogether excused. The defendant was fined 10s. and costs. The defendant remarked that Mr. Casson was considered a first-class tradesman, and it was with a desire to provide a first-class article that he had obtained the buns there.

Adulterated Milk.—Henry Blowers, local agent of the Cleveland Dairy, was charged on remand with selling adulterated milk. Mr. Fenwick, defended. Mr. F. W. Holt, sanitary inspector for the borough, had bought a pint of milk from defendant, and the County Analyst certified that the milk contained 5½ per cent of added water. Mr. A. J. M. Edger, the County Analyst, now attended court, and gave evidence as to the correctness of his certificate. There was usually 86 or 87 per cent. of water naturally in milk. The Society of Public Analysts had determined that pure milk should not have less than 9 per cent of solids not fat, there never having been known to have been less than that quantity in average milk. In the milk in question, only 8·78 per cent of solids not fat was found, which could not have been reduced except by the addition of water. There might possibly be 10 per cent. of added water in the sample produced, as his standard was low. Milk varied very little throughout the year. Mr. Fenwick declined to cross-examine the witness. A letter was put in by Mr. Pattinson, analyst, which stated that, according to the standard, there was an addition of 7 per cent. of water, but that he had examined pure milk, and found it poorer. The Bench declined to admit it, as Mr. Pattinson was not present to support it. The Bench ordered defendant to be fined 5s. and costs.

ADULTERATED BUTTER.—At the Derby Police Court, Mr. T. H. Bennett was charged with selling, to the prejudice of the purchaser, a pound of butter not of the nature, substance, and quality demanded. Mr. A. Clarke prosecuted. He said on March 16th he went to the defendant's branch shop, Stanley Terrace, Peartree Road, and asked for a pound of 1s. butter, with which he was served by the defendant's assistant. When he told the assistant who he was, and why he had purchased it, the latter said, "It is not butter, it is butterine." He did not say so till he had been told who witness was. Witness divided the butter into three parts, and sent one to the Public Analyst, gave another to the assistant, and kept the other himself. On April 26th, he received a certificate from the Public Analyst, who said that the sample consisted of two-thirds foreign fat incorporated with one-third of butter, with water 14·5 per cent., and resembled the substance known as butterine. Though animal and vegetable fats, other than butter fat, have a certain nutritive value, they have not the nature and quality of butter as an article of diet. Defendant said that the article was sold as butterine, and not as butter. The Bench imposed a fine of 20s. and costs, in all £2 8s. 6d.

ALUM IN BREAD.—At the Salford Borough Police-court, John Baxter, baker, was summoned for selling adulterated bread. Mr. Walker, assistant to the Town Clerk, prosecuted. Mr. Thompstone, inspector, stated that on the 6th May he visited the defendant's shop and saw the defendant's wife, whom he asked for a 4-lb. loaf. The bread was supplied to him, and he divided it into three parts in the usual way, at the same time telling her that he had bought the loaf for the purpose of being analysed. On the 9th inst. he again visited the shop, and purchased a sample of the flour from which the defendant said the bread had been made. He also submitted a sample of this to the analyst. Mr. J. C. Bell, Public Analyst for the Borough, said that on the 6th inst. he received a sample of bread from the last witness, which had been purchased at the defendant's shop. He analysed it, and found it to contain 40 grains of alum to the 4-lb. loaf. The flour he found to be pure. The Magistrate, Mr. Makinson, was quite satisfied that this was a very serious case of adulteration, and he was also satisfied that the adulteration had been introduced by the defendant himself. It was a very bad case. The defendant said he hoped the magistrate would be lenient, as he was a very poor man and had an aged mother to support, being also himself in delicate health. Mr. Makinson said that might perhaps induce him to be a little more lenient than he otherwise should have been; but it was a very bad case, and he should fine him £4 and costs.

NOTES OF THE MONTH.

HERE is a lovely little piece of trade journalism. Replying to J.S.B., the *Grocer* says:—"We do not recollect reporting any blunder by the analyst you refer to. The analysts are guilty of so many blunders that it is quite impossible to remember any particular case." Setting aside cases of disputed nomenclature, and what really does or does not *legally* constitute an adulteration, we hold, on the contrary, that the really chemical blunders of Public Analysts in their laboratories can be proved to be so few as to be capable of being counted on the fingers of one hand. Considering the thousands of samples which have passed through their laboratories, and the risk of accidents always inherent to chemical analysis, there are very few bodies of men who can so proudly boast of accuracy as the Public Analysts. If their opinions, founded on their analyses, have, in perhaps twenty cases altogether, been reversed in court, it is nothing more than occurs to the most learned of our judges every day. Why does not the *Grocer* abuse the Vice-Chancellors every time their decisions are reversed on appeal? Simply because it is not their unpleasant duty to be the machines by means of which the law interferes with would-be fraudulent traders. *Hinc illæ lachrymæ!*

The same print falls foul of us in a long leader, for publishing an account of the analysis of a sample of milk which was divided before being sent to Somerset House, and holds up our Publication Committee by name, as persons supporting such a course of procedure, calculated, it says, to injure the tradesman. This is another specimen of the eagerness with which the trade journals seize upon any pretext to vilify us. Is the editor of the *Grocer* to hold himself responsible for the good taste, and to consider his opinions identified with every piece of communicated news he publishes in his paper? If this be so, and he will accept such identification, we shall have much pleasure in showing him up from the news contents of his own paper, in a much worse light than he can possibly do us. Our Committee of Publication are responsible for the publication of the Transactions of the Society of Public Analysts; but for any communicated reports, correspondence, or notes, they do not assume any responsibility. If the editor of any journal or its managers are to be considered to always agree personally with every item of news they publish, then there would be an end of journalism altogether.

Setting aside all this, however, the case put in the light in which it appears in the *Grocer*, is a gross perversion of the fact. An inspector retains his sample for the protection of the analyst's reputation, and the tradesman retains his for his own protection. We have made inquiries into the particular case, and find that the court ordered the *tradesman's* sample to be sent to Somerset House, and this was done: the inspector's sample being merely sent as a check against the fraudulent tampering with the tradesman's sample, which has too often been proved to have occurred. Knowing this well, as the *Grocer* must do, unless on such points its memory is conveniently vacuous, what was wrong in also sending a portion of the inspector's sample carefully divided in presence of witnesses, and retaining some as an additional check on the possible fraud on the analyst's reputation? But no! such a vile creature is an analyst, that the *Grocer* would deny him the slightest right to protection in any form, and in fact, the sooner the reputation of every chemist in England was blasted the better, for there would then be an end to the Act, and the old style of long profits on adulterated articles would return again, and in this Millennium, perhaps, even the *Grocer* would cease from troubling and be at rest.

Mr. J. H. Collins has been appointed Public Analyst for the Borough of Helston.

Dr. W. Procter has been appointed Public Analyst for the City of York.

Dr. C. Meymott Tidy has been appointed Public Analyst for the Borough of Hertford.

Dr. W. Morgan has been appointed Public Analyst for the Borough of Tenby.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Dairyman; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; Gas Analyst's Manual, by F. W. Hartley; Commercial Organic Analysis, by A. H. Allen.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
3134	C. H. Siemens	Apparatus for Dynamical Production and Application of Electricity	1/2
3694	R. W. Wallace	Manufacture of Sulphate of Ammonia	6d.
3976	M. R. Ward	Magneto-Electric Machines	6d.
3988	St. G. L. Fox	Electric Lighting, &c.	6d.
4006	P. Jensen	Electric Lighting Apparatus	6d.
4100	F. H. Varley	Producing Electricity and Electric Light	6d.
4074	A. Arnaud	Indefinitely dividing Electric Currents	2d.
4114	E. J. Welch	Dividing and Distributing Electric Currents for Lighting	2d.
4635	Ditto	Electric Lighting	2d.
4689	Ditto	Apparatus for producing Electric Light	2d.
4131	C. Norrington	Apparatus employed in the Manufacture of Sulphuric Acid	6d.
4148	J. C. Stevenson	Apparatus for the Manufacture of Alkali	6d.
4188	E. W. Parnell	Manufacture of Alkalies	4d.
4192	P. E. Lockwood	Medicinal Compounds of Extracts of Malt	4d.
4206	R. P. Higgs	Magneto, or Dynamo Magneto-Electric Machines	2d.
4208	C. W. Siemens	Means and Apparatus for Electric Illumination	8d.
4212	C. T. Bright	Lighting by Electricity	2d.
4223	J. Johnson and M. Milton	Manufacture of Gas	2d.
4226	T. A. Edison	Developing Electric Currents and Lighting by Electricity	1/-
4283	J. E. Stokes	Electric Lighting	6d.
4313	A. A. Cochrane	Obtaining and applying Electricity	2d.
4315	B. P. Stockman	Apparatus for producing Light and Electricity	2d.
4316	J. W. T. Cadett	Electrical Arrangements	6d.
4317	F. D. Tilleard	Lamps for Lighting by Electricity	2d.
4338	C. W. Harrison	Obtaining Light by Electricity	2d.
4344	F. J. Odling	Gas Batteries for the production of Electricity	2d.
4347	J. S. Wilson	Apparatus for producing Electric Light	6d.
4353	J. Imray	Treating Ammoniacal Liquor for the separation of Ammonia Compounds therefrom	4d.
4376	A. Scott and A. McDonald	Treating Residual Liquids in Sugar Manufacture	2d.
4388	S. F. Van Choate	Producing Electric Light, &c.	4d.
4452	S. G. Thomas	Manufacture of Phosphates and Manures	4d.
4558	Ditto	Ditto ditto	4d.
4456	F. H. Higgins	Apparatus for producing and subdividing Electric Light	6d.
4462	H. L. Thomas	Production of Electric Light	2d.
4466	C. Stewart	Distributing Electricity for the production of Electric Lights	6d.
4473	F. Gye	Apparatus for obtaining Electric Light	2d.
4502	E. G. Brewer	Lighting by Electricity	6d.
4517	J. Hardman and G. Wischin	Production of Anthracene	2d.
4526	J. Young	Manufacture of Ammonia	6d.
4549	J. Holloway	Treatment of Sulphides, &c.	4d.
4553	M. Gray	Manufacturing Carbons for Electrical Purposes	4d.
4559	C. Davis	Mechanism for producing Light and Heat by Electricity	2d.
4568	J. Mackenzie	Electric Light Apparatus	2d.
4573	G. Zanni	Apparatus for production of Light by Electricity	6d.
4575	H. W. Tyler	Electric Lighting	2d.
4611	E. Edwards and A. Normandy	Producing Light, &c., by Electricity	4d.
4646	J. S. Sellon and W. Ladd	Electric Lamps	6d.
4650	T. Clarke and E. Smith	Manufacture of Sulphuric Acid	8d.
4664	F. Ransome	Manufacture of Cement and Artificial Stone	4d.
4684	F. Wirth	Recovering Potassium of the Tartar as Hydrate of Potassa in Manufacture of Tartaric Acid	4d.
4690	J. H. Johnson	Electric Regulators, Lamps or Candles	2d.
4831	E. Packard, Junr.,	Treating Bones for Manufacture of Manure	4d.
1879.			
144	W. Morgan Brown	Electric Lighting, &c.	6d.

THE ANALYST.

AUGUST, 1879.

THE COMPOSITION OF DEVONSHIRE CREAM.

By A. Wynter Blyth, M.R.C.S., &c.

Read before the Society of Public Analysts, on 4th June, 1879.

I have recently been studying the composition of the substance known as Devonshire cream, and find the average composition as follows :—

	per cent.
Water	28·675
Caseine	3·530
Albumin	·521
Galactine	·050
Lactochrome	Undetermined
Milk Sugar	1·723
Milk Fat	65·011
Ash	·490
Chlorine in Ash	·013
Calcic Phosphate	·373

It will thus be seen that the milk has thrown up caseine with the fat, for if we allow that ordinary milk contains 86·87 of water and 3·98 per cent. of caseine, then the amount of caseine in the cream, if none were separated, would be—

Water. Caseine. Water. Caseine.
86·87 : 3·98 : 28·675 = 1.31

But the cream instead of containing 1·31 per cent. actually contains 2·22 in excess of this quantity.

The amount of albumin follows strictly the caseine, for if we allow, as I have elsewhere affirmed, that the average percentage of albumin in milk is ·77 per cent., and therefore the ratio of caseine to albumin as 3·98 is to ·77, then the theoretical yield of albumin in this particular case would be ·66, the amount actually found being about ·1 per cent. lower than this estimate.

If the composition of the Devon cream shows clearly that there is some considerable separation of the caseine, the milk sugar follows very closely the proportions one would expect to find from the amount of water for taking the average of 4·0 of milk sugar dissolved in 86·87 of water, then in the present case—

Water. Sugar. Water. Sugar.
86·87 : 4·0 : 28·7 = 1·3

Which does not deviate very considerably from the numbers actually obtained, viz., 1·723.

Pursuing the ratios still farther it will be noticed that the galactine also follows the same law, for if the number I have elsewhere given as the average percentage of this body in milk, viz., ·17, be taken, then

Water. Galactine. Water. Galactine.
86·87 : ·17 : 28·67 = ·056

And ·050 is the number experiment has yielded. Similarly the percentage of ash, which always depends upon two factors—one, the caseine ; and two, the amount of water—may be similarly proved to agree closely with that which theory demands.

The analysis of Devon or any other cream presents but little difficulty: a weighed portion is taken, the fat melted, and after about half an hour's exposure to the heat of a water-bath, most of the caseine, &c., settles to the bottom, and the fat can be poured off as easily as that from butter. The residue remaining is now treated with petroleum and thoroughly exhausted. "The fat" and "solids not fat" are dried separately, which indeed is the only way in which the water can with any convenience be estimated.

With regard to the estimation of the other constituents, I have nothing new to add.

ON THE ANALYSIS OF BUTTER FAT.

By Frank P. Perkins, *Public Analyst for Exeter.*

Hitherto the determination of the volatile as well as the non-volatile acids, contained in butter, has generally been accomplished in the gravimetric way. Satisfactory, however, as the processes which have been devised in this direction may be, there is little doubt that they are somewhat tedious to perform; and although where the greatest accuracy is required, analysis by weight must always rank the highest, yet a fairly accurate volumetric method, easily and rapidly executed, must be a desideratum. A few steps towards this end have already been made. In the first volume of The Analyst there is a paper by Dr. Dupré devoted principally to the volumetric estimation of the *volatile acids* in butter, and in a paper lately published in the same journal by Dr. Koettstorfer, the author proposes to determine the *non-volatile* acids volumetrically. About a year ago, I showed how the amount of volatile acids may be approximately ascertained by taking the acid filtrate derived from the insoluble acids, titrating a portion of it with K Ho to determine total acidity, evaporating another known portion to small bulk, titrating again, and then converting the difference between the two experiments to butyric acid. I have now made a further advance. On referring to Messrs. Angell and Hehner's treatise on "Butter," it will be found that the endeavour to obtain the amount of volatile acids by saponifying the fat and then distilling with sulphuric acid, was futile, the distillation was difficult to manage, and the results unsatisfactory; but I find that, by liberating the fatty acids with oxalic acid this difficulty is overcome, and I believe that the method now proposed will be found simple, workable, and fairly accurate. It is as follows. Weigh out 1 to 2 grammes of purified butter fat, saponify in a beaker in the usual way, drive off the alcohol, cool, set free the acids by adding a cold saturated solution of oxalic acid in very slight excess, pass through a small filter, previously moistened with water, wash the insoluble acids thoroughly, first by decantation with cold, and lastly with hot water on the filter, make up the filtrate to, say, 200 c.c., transfer 100 c.c. to a small retort connected with a condenser and distil slowly until the *whole* has passed over, add a few drops of litmus *solution, titrate with* deci-normal K Ho, calculate the amount consumed by the volatile acids in 100 grammes of fat, and translate to butyric acid $\left\{\begin{matrix} C_3H_7 \\ C\,O\,Ho. \end{matrix}\right.$ The insoluble acids on the filter are treated with hot alcohol, the fluid holding the acids in solution being received in a flask. The filter is washed with alcohol until it no longer reddens litmus, and the filtrate is made up to 100 c.c. with alcohol. Half of this is taken, coloured with a suitable indicator, and heated gently; deci-normal K Ho is run in and the number of cubic centimetres required for neutralization noted, the second portion is similarly treated. The first experiment serves as a guide to colour, &c.; the number of cubic centimetres used is ascertained, and the amount required by the non-volatile acids in 100 grammes of fat calculated. For the purpose of comparison with fats used as adulterants, it may, perhaps, be convenient to convert this to stearic acid $\left\{\begin{matrix} C_{17}H_{35} \\ C\,O\,Ho. \end{matrix}\right.$

Experiment 1.—1·351 grammes of purified fat from good farm butter was taken. The solution containing the volatile acids was made up to 300 c.c. The distillate from 100 c.c. required 8·5 c.c. K Ho. This on 100 grammes of fat gave 4·31 K Ho or 6·7 butyric acid.

Experiment 2.—The alcoholic solution containing the non-volatile acids of the above was made up to 100 c.c. 48·8 c.c. of K Ho were required. This on 100 grammes of fat gave 18·14 K Ho or 92·0 stearic acid.

Experiment 3.—1·19 grammes of fat from another sample of the same class was taken. The solution containing the volatile acids measured 170 c.c. The distillate from 100 c.c. required 5·6 c.c. K Ho. This calculated on 100 grammes of fat gave 4·42 K Ho or 6·8 butyric acid.

Experiment 4.—The alcoholic solution containing the non-volatile acids of the above required 88·5 c.c. K Ho. This on 100 grammes of fat gave 18· K Ho or 91·7 stearic acid.

These results agree closely with those obtained by Dr. Koettstorfer. Thus—

	Per cent. of K Ho.
Experiment 1.—Volatile acids	4·31
Experiment 2.—Non-volatile	18·14
	22·45
Experiment 3.—Volatile acids	4·42
Experiment 4.—Non-volatile	18·0
	22·42

AMERICAN BAKING POWDERS AND ALUM.

By Henry A. Mott, Jr. Ph.D., E.M.

From the Scientific American.

Having been appointed Chemist by the United States Government for the Indian Department, it became my duty to submit to chemical analysis, among other articles, the various baking powders offered the department, and as a result of my investigation I found that at least fifty per cent. of the baking powders offered were grossly adulterated. After making this discovery I determined to submit to analysis every baking powder I could find on the market, and to expose such powders as were adulterated, so that the public may be warned from purchasing them in the future. The number of baking powders I have examined amounts to forty-two—twenty-nine of them from various sections of the country having been offered to the department, and thirteen obtained from various grocery stores throughout the city of New York.

Instead of the baking powders of commerce being composed alone of those constituents which have been demonstrated to be perfectly harmless and wholesome, the public have imposed upon them powders largely adulterated with most injurious and hurtful compounds, put up in cans neatly labelled "chemically pure," as if that fact (?) had anything to do with rendering the powders wholesome. Scheele's green (arsenite of copper) is often "chemically pure," but it is always a deadly poison.

It, therefore, becomes necessary for the benefit of the public to examine into the the powders on the market, and to denounce such of them as are composed of constituents detrimental to health.

The best powders are composed of bitartrate of potash (cream of tartar), tartaric acid, carbonate of ammonia, and bicarbonate of soda, held together to prevent decomposition by a little starch.

The injurious powders are composed of alum and bicarbonate of soda, and often contain terra alba (white earth), insoluble phosphate of lime, &c., &c. The effect of alum when taken internally has been shown by Wilmer and others to produce dyspepsia, constipation, vomiting, griping, and even inflammation of the gastro-enteric mucous membrane, as it is a powerful astringent acting chemically on the tissues. These serious effects will not of course be brought about immediately from the small quantity of alum used in one loaf of bread, but it is certain that persons continuing to eat bread containing alum will, in time, suffer from its evil effects, and the weaker the constitution the sooner will the effects be noticed.

Duma speaks to the same effect when he says: "It is to be feared that this salt exerts a deadly action by its daily introduction into the stomach, especially in persons of a weak constitution." And other great authorities, such as Carpenter, Dundas, Thompson, Gibbon, and Normandy, all agree that the continued use of bread containing alum will bring about dyspepsia and other troubles, and such was the opinion of the late Baron Liebig. The celebrated Pereira considered "that whatever may have been the effect in the case of healthy persons, sick persons did really suffer in that way." In the *Lancet* is mentioned a case in whom dangerous gastro-enteritis was apparently induced by a single dose containing between ten to twenty grains of burnt alum. Dr. Parkes, in his work on *Hygiene*, states that from eight to forty grains of alum, and probably more, have been found in a four-pound loaf of bread.

The effect of alum on bread is to tend to whiten it, and to prevent an excess of fermentation (when yeast is used), when the altering gluten or cerealine acts too much on the starch; but while it accomplishes this object, it lessens at the same time the nutritive value of the bread by rendering the phosphoric acid insoluble.

Out of the many baking powders I have examined, I have selected the more ones that are adulterated, giving in each case a quantitative analysis of the same. The analyses of the last three baking powders given in the first column were made by Professor Robert W. Schedler.

No. 1.

Burnt alum	26·45 per cent.
Bicarbonate of soda	24·17 " "
Sesquicarbonate of ammonia	2·31 " "
Cream of tartar	None
Starch	47·07 " "
	100·00

No. 2.

		Analysis by Dr. Mott.
Burnt alum	19·16 per cent	20·03 per cent.
Bicarbonate of soda	23·36 " "	22·80 " "
Cream of tartar	None	None
Starch	57·48 " "	57·17 " "
	100·00	100·00

No. 3.

		Analysed by Dr. Mott.
Burnt alum	29·60 per cent	30·06 per cent.
Bicarbonate of soda	31·13 " "	31·82 " "
Cream of tartar	None	None
Starch	39·27 " "	38·12 " "
	100·00	100·00

No. 4.

Burnt alum	22·53 per cent.
Bicarbonate of soda	21·79 " "
Cream of Tartar	None
Starch	56·68 " "
	100·00

Not one pound of these powders could be sold in England, as it is against the law to use alum for making bread. Why have we not such a law? A case is reported in the English Law Reports of 1871-2, 7th Queen's Bench, 135, November 15, 1871, where a baker was convicted for using alum in making bread. What would become of the above-mentioned baking powders containing alum if they were introduced on the English market? The answer is simple—they would be swept out of existence.* It is to be hoped, then, that the public, by refusing to purchase them, will bring to them all the same fate.

By exposing these injurious and unwholesome baking powders, the public must not be frightened from using baking powders when properly made—of which I have already stated there are a number on the market. In fact, baking powders are a great convenience, as the constituents are so combined that their use is always attended with success: and there is no danger of biscuits made with them having an alkaline taste, or being impregnated with yellow specks or streaks, as is often the case when ordinary cream of tartar and soda are used. This results from the fact that the ordinary cream of tartar found in market is adulterated from 10 to 90 per cent. with foreign substances; consequently, it becomes necessary to change the proportion to be used with every new lot, which can only be correctly arrived at by a chemical analysis of the cream of tartar.

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* We fear the success of the English Act is not quite so complete as Dr. Mott seems to suppose.—[Eds. Analyst.]

The advantages of using "baking powder" in preference to yeast, are that with the former none of the nutritive parts of the flour are destroyed, a larger yield is obtained, and the result accomplished with a great saving of time, which would otherwise be required to promote the fermentation when yeast is used.

The advantages of using "baking powder" in preference to the ordinary cream of tartar and soda found on the market are not only that it is more economical, but the results are always attended with success, there being no fear, as stated, of producing an alkaline taste or yellow streaks in the product.

CONDENSED MILK.

THE *Neue Freie Presse* has, very recently, published a series of letters and articles on the above subject, which possesses special interest for analysts, as bearing on Mr. Hehner's recent paper on the same subject, and the discussion which then took place.* Unfortunately the correspondence and articles are throughout written in a tone of recrimination, which we have seldom seen in any English periodical treating on scientific subjects; such phrases as "insulting advertisements," and "to unmask calumniators," are plentifully scattered through the writings of both sides. This is the more to be regretted, as it only diverts attention from the real point at issue, which is simply whether the condensed milk manufactured by one of the foreign companies is produced by the concentration of genuine milk, or of skimmed milk.

The matter appears to have been originally brought forward by Dr. F. Sexhlett, and the analyses on which he bases his opinion appear to have been made in the ordinary course of his official work in the Imperial and Royal Chemical and Agricultural Institute, at Vienna. He quotes a very large number of analyses which he has made of samples from different condensed milk companies, but he considers the result of these analyses mainly by determining the ratio between the caseine and the fat. This is entirely different from the method adopted by Mr. Hehner, who deduced the concentration of the milk mainly from the solids not fat.

Dr. Sexhlett points out that the fat, in genuine milk, is in almost every case in excess of the caseine present. Thus he quotes König, who finds, on an average of 400 analyses of cows' milk, caseine to fat as 100 to 110; Fleischer, in 170 analyses, never found less than 100 parts of fat to 100 of caseine; G. Kuhn, in 173 analyses, only found 14 in which the fat was less than the caseine, the minimum being 88·5; while Dr. Sexhlett himself has in only one single instance found the proportion of caseine to fat as 100 to 87.

Referring, however, to milk from the Alpine districts, which is the class of milk that is mainly in dispute in this correspondence, a number of recent analyses are quoted, showing an average of 146 parts of fat to 100 parts of caseine as being the average produce of the districts.

Passing from the question of the composition of the original milk before concentration, a number of analyses are put forward of samples supplied by different condensed milk companies to show the proportion which the caseine and fat bear to each other in the finished product, and in four particular instances the results were as follows:—

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* See ANALYST, vol. iv., pp. 44 and 72.

	Proportion of Caseine to Fat.	
Tin from Vienna	100	66
,, ,,	100	64
,, Bruner	100	71
,, Prague	100	73

From these facts Dr. Sexhlett comes to the following conclusions:—1st. The milk contained in each tin was differently composed, and therefore he did not possess samples of one and the same concentration, but of four different ones. 2nd. In every one of these four samples the relative proportion of fatty substances to caseine was such as is never found in ordinary milk from a cow, or even in the best milk from the Alps. Until now such a proportion was found only in skimmed milk, and it is evident therefore that the four samples, the analyses of which are given above, were manufactured with skimmed milk.

Further on, in Dr. Sexhlet's report, we find another analysis of a sample said to be the milk of the "Helvetia" Company, which probably corresponds with the samples bearing the same mark referred to in Mr. Hehner's paper, but the difference between the latter samples and that referred to here is remarkable. Although the amount of water is fairly concordant, Mr. Hehner's samples contained more than 2 per cent. less fat and about 1 per cent. less caseine; but it is unfortunate that no attempt was made to separate the cane sugar from the milk sugar in Dr. Sexhlett's sample, which is also viewed by him as a skimmed milk.

To justify the points he brings forward, Dr. Sexhlett gives quotations from the Report of the Commissioners on the projected German law affecting the sale of articles of food and consumption. As these quotations have not previously appeared in their entirety in our columns, it may be worth while to give them. The report (Berlin, 1878) states:

> "Milk, in its ordinary composition, contains all the nutritive elements necessary to the human body, and that in a form which suits man. If, however, certain elements are wanting therein, such as *cream*, which is not only one of the principal integrant aliments, but which is also indispensable to the other component parts of milk, or should such a quantity of water have been added to the milk as to cause a deficiency in the daily quantity corresponding with the capacity of the bowels of the child, the result will be decline and consumption.
>
> "When the first illness has once appeared, however harmless its symptoms may seem, a child may be carried off suddenly without being able to resist under such circumstances.
>
> "Those selling skimmed milk, or milk understood to have lost part of its value by skimming, as whole milk, for the nourishment of children are, according to the facts before mentioned, for having jeopardised the health of children and sick persons, guilty of having prejudiced their health, and it shall no longer be considered a matter of hazard hereafter if the wholesale murder of infants, favoured by existing circumstances, shall continue or not.
>
> "Skimmed milk is more or less deficient in fats contained in pure milk, and is therefore wanting in one of its principal component parts. It has therefore less value, and is unfit for the nourishment of young children. Its sale, under the name of whole milk, is not admissible."

All that was said by Mr. Hehner, and enforced by Dr. Muter and other speakers at the February meeting of the Society of Public Analysts, as to the danger of using condensed milk as infants' food when diluted in anything like the proportions directed on the tins in which it is sold, are echoed and enforced in this correspondence in even stronger language, the only misfortune being that, owing to the personal bias which runs through the whole thing, the condemnation is applied principally to the milk of one or two companies, instead of being extended as it justly should be to all kinds of condensed milk. Especial attention, for instance, is drawn to the fact, that the directions on the cans state that when "diluted in a small quantity of water it becomes like the finest cream," while the simple fact is that the condensed milk itself contains less fat than even the poorest sample of cream which could be obtained. Dr. Sexhlett says, that "the height of impudence is reached when it is asserted that condensed milk is, without contradiction, the best food for children, and is far better than non-condensed milk."

Independently, however, of all this discussion, whether a certain milk is skimmed, there is one very serious point to consider, which concerns all who have to do with condensed milk, either in manufacture or for the purpose of analysis. It is confidently asserted by persons who have for a long time been preparing condensed milk that, not only does decomposition of the caseine occur during the boiling process, but that a by-no-means inconsiderable proportion of the fat distils over with the evaporated water, if the temperature in which the evaporation is carried on is allowed to rise sensibly above 100° F. If this is the case the milk loses doubly during the concentration—1st. There is an actual loss of nitrogenous matter by decomposition which will ensue, under any circumstances, by continued boiling in the presence of the large amount of cane sugar that is usually added, and which is still further increased by the fermentation frequently set up in milk that is not quite so fresh as might be desirable; and, 2nd. There is the large loss of fat which forms quite as essential a constituent of milk, and which is not only partly volatilized, but without doubt, under such circumstances, is partially decomposed during the volatilization, so that the fat which is left behind in condensed milk, provided any portion of the fat has been volatilized, would probably not have the composition of true butter fat, but would contain volatile and fixed acids in different proportions to those found in genuine butter.

This subject is certainly worth fuller investigation than it has received at present.

SALE OF FOOD AND DRUGS ACT AMENDMENT BILL, 1879.

This Bill has passed through the House of Lords, and received the Royal Assent on the 21st July. We shall reprint the Act in our next number.

Extraordinary Reason for Committing Suicide.—An inquest was lately held by Mr. Payne, the City Coroner, into the circumstances under which Walter Hazell, aged forty-four, a milkman of 1, Walker Street, St. George's, Southwark, came to his death. Mrs. Hazell said the deceased was a man of robust health, although addicted to habits of intemperance. A few days previously one of the sanitary inspectors of the district called and purchased a sample of milk, at the same time telling deceased that the milk would be examined by the Public Analyst. This circumstance seemed to give deceased a great deal of anxiety, and he told more than one person of his apprehension of being summoned before a magistrate, and being fined. On the morning in question deceased rose as usual—very early in the morning, and upon his wife going down-stairs some time afterwards she missed him. Search was made, and Hazell was found with his head downwards in the water-butt in the back yard of the house. The jury returned a verdict of "Suicide whilst temporarily insane."

Erratum.—In Mr. Allen's paper on Tinctures, page 106, line 7, *read*, "the proportion of oil of anise *which could be dissolved* by spirit of 30° U.P. *(instead of O.P.)* was a mere fraction of that taken up *by proof spirit.*"

ASSAY OF CRUDE CALCIUM ACETATE.

By August Stromeyer.[*]

Crude Calcium Acetate, sold for making acetic acid, is now often tendered for analysis. The author used to calculate the acetic acid from the amount of soluble calcium. A known quantity of the sample was dissolved in water, filtered and precipitated with ammonium hydrate and ammonium carbonate. The precipitated calcium carbonate was ignited to destroy organic matter, and dissolved in a measured quantity of standard nitric acid. By adding litmus and standard alkali the amount of nitric acid neutralised could be readily ascertained, and had only to be calculated to an equivalent amount of acetic acid. Other chemists prefer to evaporate the solution of the calcium acetate to dryness, and to ignite the residue instead of precipitating with ammonium carbonate.

This apparently simple method is not, however, satisfactory, since manufacturers of acetic acid can never get as much acetic acid as the analysis shows. The author thinks there is another acid present not volatile at the boiling point of acetic acid.

The following process given by Fresenius gives about 4 per cent. less acetic acid than the one described, but seems more satisfactory to the manufacturers :—5 grammes of the sample are put into a retort, mixed with 50 c.c. phosphoric acid of 1·2 sp. gr., and the whole distilled nearly to dryness. The distillation is repeated after adding 50 c.c. more of the acid, and then again by adding 50 c.c. of water. The acetic acid is estimated by standard alkali.

THE CHEMISTRY OF AN ORANGE.

From the Boston Journal of Chemistry.

It proved so difficult a matter to find a clear and reliable analysis of the orange in the literature of chemistry that, previous to leaving this city for Florida, we determined that the work of analysis should be undertaken. A medium-sized Florida orange, purchased in Faneuil Hill market, afforded upon analysis the following results:

The skin	weighed	57·5 grammes,	which is	23·33	per cent.
,, seeds	,,	7·0	,, ,,	2·84	,, ,,
,, pulp	,,	182·0	,, ,,	73·83	,, ,,

The *skin* contained in 100 parts:

Water and volatile oil	78·00
Organic matter	21·36
Ash	·64

The *seeds* contained in 100 parts:

Water	50·00
Organic matter	48·64
Ash	1·36

The *pulp* contained in 100 parts:

Water	90·99
Organic matter	8·68
Ash	·33
The pulp contained in 100 parts	4·3 grape sugar, 4·2 cane sugar, 1·0 free acid.

The free acid consisted of about equal parts of malic and citric acid.

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[*] *Correspondenz blatt des Vereines analytischer* chemiker, Jahrg 2, No. 7.

The ash constituents of the orange were as follows:

Potash	38·7
Soda	7·6
Lime	23·0
Magnesia	6·5
Ferric phosphate	1·7
Sulphur	2·9
Silica	5·2
Phosphoric acid	14·1

From these results it is seen that the orange is not a very great robber of the soil; indeed, it would appear that the growth of fruit depends so slightly upon important inorganic constituents, that fertilization in good soils is hardly necessary. The food most largely drawn upon for the formation of skin, pulp, and seeds, is potash, and next come lime and phosphoric acid. In one hundred pounds of the fruit there are but two and one-third pounds of ash, and nearly one pound of this is potash. It is evident that ashes and phosphoric acid are the forms of food demanded in the growth of the orange, and on poor soils this may be supplied with advantage. It is found in Florida that in the cultivation of the orange great persistency in bearing is maintained, and in the apparently pure white sand of the State it flourishes for many years, and yields constant returns. This renders it a valuable and remunerative crop, and upon it Florida must largely depend for its resources.

WATER SUPPLY OF MONTREAL, CANADA.

We have received from Dr. Baker Edwards, of Montreal, two small pamphlets on the character of the different water supplies of that town, and of the shore and river ice taken from the river St. Lawrence. The analyses of the ice show rather more organic suspended matter than we should have expected to have found, the shore ice containing two grains per gallon and the river ice one grain per gallon. These figures are, however, according to Dr. Edwards' analyses, considerably less than those which are frequently found in the unfiltered water supply of the city, and he takes the opportunity of pressing strongly upon the city authorities the necessity for efficiently filtering all the water before it is supplied to the town. The main feature in connection with the analyses of some twenty-five samples of the different river waters is their extreme softness, and the small quantity of animal matter which they contain; and it certainly is very singular that the one sample of the town supply should, in both these respects, as well as in the amount of organic carbon which it contains, stand very greatly at the head of the list as the most impure water. This would seem to indicate not only that filtration is neglected, but even storage of the water must be very inefficiently carried out at Montreal.

SOCIETY OF PUBLIC ANALYSTS.

The Country Meeting of this Society will take place at Sheffield during the Meeting of the British Association, and will probably be fixed for the afternoon of Friday, 22nd August, in the Library of the Literary and Philosophical Society, Arundel Street.

The usual Notice will be sent to Members.

REVIEWS.

An Introduction to the Practice of Commercial Organic Analysis.

By Alfred H. Allen, F.C.S. London: Churchill.

It is refreshing to meet with a new work on Chemistry, having a real *raison d'être* like that possessed by the book before us. It professes to be a treatise on the properties, proximate analytical examination, and modes of assaying the various organic chemicals and preparations employed in the arts, manufactures, medicine, &c.; with concise methods for the detection and determination of their impurities, adulterations and products of decomposition, and it is introduced by the author with the following forcible remarks:—"While the libraries of chemists are replete with manuals and treatises on inorganic analysis, and the number of these works is being increased almost monthly, books on organic analysis are chiefly conspicuous by their absence. It is a lamentable fact that while our young chemists are taught to execute ultimate organic analysis, and to ring the changes on the everlasting chloro-bromo and nitro-derivatives of bodies of the aromatic series, the course of instruction in many of our leading laboratories does not include even qualitative tests for such every-day substances as alcohol, chloroform, glycerin, carbolic acid and quinine. As a natural consequence of this neglect, the methods for the proximate analysis of organic mixtures and for the assay of commercial organic products are in a far more backward state than is justified by the inherent difficulties of this branch of analysis." These strictures are unfortunately but too true, and, as we have again and again had to point out, the tendency of the present would-be leaders of chemistry in England is to ignore the workers in purely analytical research and exalt the "organic manufacturing investigators." There are, however, many signs of a re-action setting in, and the time will come when the practical researches of the analysts, whom we represent, will be more thought of than those of the persons who now profess to hold us in contempt.

Such being Mr. Allen's excellent ideas in commencing his work, let us see how far they have been followed up. In the first place, the author intended to practically verify every process personally, but after some years of labour he found that not only was the work beyond the power of any one man, but that even when carried out the information obtained would most probably become stale long before the whole work could be finished, and he has therefore published the present volume as an instalment of what is to follow. Opening with the cyanides, this volume takes us through the alcohols, simple, haloid and compound ethers, and the chief acids, ending with the phenols and their acid derivatives. The second volume is to contain oils, fats, soap, and essential oils, although certain of the latter which are chiefly aldehyds, or compound ethers are included in the first volume. The author apologises for not making his style more "telegrammatic," but we think had he done so, he would have spoiled the work, which has just that judicious amount of "padding" necessary to commend it to more elementary readers, while the processes are described in a manner sufficiently detailed, and yet not so much so as to be wearisome to the professional men for whom the work is chiefly intended. We are spared the stereotyped descriptions commencing with—"take a basin," or "put into a burette," and the strengths of the various solutions are indicated once for all in a table at the beginning of the book, and afterwards simply referred to as "deci-normal," "normal," &c., which saves many vain repetitions. It would be impossible to go into all the various processes mentioned and criticised in the book, but we may say that there are few works where so much real practical information is condensed within 350 pages. To many the book would be worth buying, even if it had nothing else than the excellent article on the detection and estimation of alcohol, and the carefully compiled tables therein contained, enabling an analyst to tell with the greatest facility the exact amount of water which has been added to a bulk of gin of any given strength, to reduce it to the strength found. We shall look anxiously forward for the next volume of Mr. Allen's work, because the present is certainly one without which no analyst's library can be considered complete, and which in a marked degree advances the already high reputation of its author. To Public Analysts, who are so much engaged in organic work, it is simply invaluable, and it has the merit of also being fairly well printed, although the author here and there suffers from the terrible havoc compositors are apt to make with chemical symbols. A work on chemistry without such errata would, however, be a thing we might wish for but never meet with, and in the present case the errors are commendably few.

On the Estimation of Phosphoric Acid, by Magnesia, for Commercial Purposes. By E. F. TESCHEMACHER AND J. DENHAM SMITH. London: Hardwicke, 1879.

THIS *brochure* is devoted exclusively to the consideration of the process which Messrs. Teschemacher & Smith have for some years employed in their commercial analyses. Its publication at the present time is the more satisfactory, because the authors' process has always, rightly or wrongly, been looked upon as a secret one.

We must refer our readers to the publication itself for the details of the process, as we have only space to point out that its principal features consist in the solution of the mineral phosphates in concentrated hydrochloric acid, so as to ensure expulsion of all the fluorine in the precipitation of the lime by adding the boiling solution of the sample to a solution of oxalic and citric acids, and then completing the precipitation by a very gradual addition of ammonia water, the solution being acidified with acetic acid before filtration, and in invariably re-dissolving and re-precipitating the ammonia magnesian phosphate.

As the result of many experiments the authors conclude that ammonia magnesian phosphate is practically insoluble in ammonia water.

The Gas Analyst's Manual. By F. W. HARTLEY. London: Spon, 1879.

MR. HARTLEY'S name is so well known in connection with gas testing apparatus that we naturally expect to find a high standard of accuracy and excellence in the work before us, and we are not disappointed. The work does not profess to introduce any new methods or processes, but it is a carefully prepared *resumé* of all the processes in use for gas analysis. Prior to the publication of the book, there was no comprehensive work published which gave the gas analyst all the necessary instructions for performing *the ordinary* routine of gas testing. As far as London is concerned, the gas referees' instructions gave all the necessary information to carry out the tests according to the method prescribed by them, but these instructions were not generally available. Mr. Hartley has wisely embodied these instructions in the present volume. The description of the various prices of apparatus employed, and the modes of testing and adjusting them is carefully written.

The book will be of special value to those who are only called upon to test gas occasionally.

Ammonia Liquor Tests. By F. W. Hartley, 85, Millbank Street, S.W.

This is a handy little pamphlet, but its main value consists in its being another determined blow at one of those crude processes of so-called analysis which have been retained in our Chemical Works long after their fallacies have been exposed in the Laboratory.

The author points out the great errors incurred by estimating the strength of gas liquor by the specific gravity, or by simple titration instead of by distillation and titration.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—In the month of February I made an official inspection of some cow stables, at a place called Blissville, on Long Island, which were connected with a distillery. Thinking that my investigations at that time might prove of some interest to yourself and other Public Analysts, I take the liberty of writing you upon the subject.

At the time of my visit to the above stables there were between 700 and 800 cows in them, crowded into narrow stalls, to which they were fastened by a rope not more than three feet in length, which barely permitted them to lie down, but kept their mouths continually at a trough into which flowed the "*swill*" from the adjacent distillery in a steaming and fermenting condition.

Most of the animals were emaciated and feverish, and were affected with cough, diarrhœa, and polyuria. Some appeared to have recently arrived, and were in good condition. The temperature of several of the animals was noted, and ranged from 102° to 109°. The stable floors were kept all the time wet and slippery with excrementitious matters, and I did not see how it was possible for the cows to be milked and prevent the surrounding filth from splashing into the milk.

These poor creatures, crowded together within low sheds, with insufficient food, imperfect or no means of ventilation, no exercise, no pure water to drink, and breathing an atmosphere poisoned by the exhalations from their wretched bodies, their excretions, and the steaming and fermented food, are expected, under these conditions, to secrete milk fit for human consumption.

I obtained some milk from two cows, each specimen of which I submitted to analysis. It is of the quality one would expect it to be from animals fed on such food and kept in such unsanitary surroundings.

I. Re-action one hour after milking, very acid. Cream, 5½ per cent. by volume.

Average of two analyses :—

Water	89·18
Fat	1·28
Sugar	4·66
Caseine	4·225
Ash	0·655
	100·000
Solids, not fat	9·54

II. Re-action, acid. Cream, 4 per cent. by volume.

Average of two analyses :—

Water	89·80
Fat	1·19
Sugar	4·18
Caseine	4·16
Ash	0·67
	100·00
Solids	9·01

Examined microscopically, the fat globules were very small, scanty, and aggregated, and I also observed some epithelium, and cells resembling those found in colostrum.

I have the honour to remain, very respectfully,

J. BLAKE WHITE, M.D.,
Inspector of Milk, City, New York.

NEW YORK, *June 18th, 1879.*

ANALYSTS' REPORTS.

Mr. J. Carter-Bell, Public Analyst for Cheshire, has reported to the Court of Quarter Sessions that during the past quarter he examined 148 samples. These were—62 of milk, 24 water, 18 bread, 15 flour, 9 whisky, 8 coffee, 4 gin, 2 brandy, 2 pickles, 1 rum, 1 vinegar, 1 oatmeal, and 1 chocolate. Of these 23 were adulterated, consisting of 15 milks, 5 whiskies, 1 brandy, 1 gin, and 1 coffee. The report also stated that in Cheshire, a county where the pasture was exceptionally good, and where excellent milk should be produced, the average of the samples taken was exceptionally bad, nearly one-third being below the ordinary standard of poor milk. In Salford, where the milk was very closely watched, it was difficult to find an adulterated sample.

Mr. J. Carter-Bell, Public Analyst for Salford, in his report for the quarter ending 30th June, states that he examined 136 samples, consisting of 47 breads, 57 milks, 15 buns, 10 flours, 2 teething powders, 2 medicines, 1 butter, 1 cider cream, and 1 egg-powder. Of these 10 were adulterated, consisting of 6 milks, 2 buns, and 2 breads. The greatest amount of water in the milk was 15 per cent. One sample of bread contained as much as 45 grains of alum to the 4lb.-loaf. The cider cream, which he believes is chiefly sold to children, was composed of strong vinegar slightly flavoured with a little acetate of amyl. The teething powders were composed of metallic mercury, morphia, and chalk. At the end of the last and the beginning of this quarter the adulteration of bread with alum was prevalent, but owing to the increased vigilance of the inspector, not a sample of alumed bread could now be found."

Mr. J. Baynes, Public Analyst for the East Riding of Yorkshire, reports that during the past quarter, 42 samples were submitted to him, *viz.*:—2 arrowroot, 1 bread, 3 butter, 1 baking powder, 7 coffee, 1 cocoa, 2 ginger, 4 lard, 7 milk, 1 mustard, 8 nitre, 2 oatmeal and 2 pepper. Of these 5 samples of nitre were adulterated—4 were brought from grocers and 1 from a tailor. 3 coffees contained 16, 30, and 48 per cent of chicory respectively. 1 lard 15 per cent of water, 1 milk 10 per cent of water.

Mr. Baynes also reports that as Analyst for Hull, he examined 2 samples during the quarter, *viz.*:—1 water and 1 milk both of which were pure; these were sent by the medical officer, owing to Scarlet Fever being prevalent.

MR. CARTER-BELL writes to request us to draw attention to the fact that the tables in his paper on alum in flour and bread, published in the ANALYST for July, are calculated on the basis of 3-lb. of flour per 4-lb. loaf, an amount which is in excess of the quantity usually employed, and since adopted by him as a basis of calculation.

"THE PREJUDICE QUESTION."—For the information of analysts who may possibly have to refer magistrates to the recent decision on this point in Hoyle, *v.* Hitchman, we may state that that case is *now reported in Law Reports*, 4 Q.B.D., 233 ; 48 *Law Journal*, M.C. 97 ; 40 *Law Times*, 252.

LAW REPORTS.

Heavy Fine for Butterine.—At the Sittingbourne Petty Sessions, Mr. Samuel Wood, grocer, of Milton-next-Sittingbourne, was summoned for selling as butter, an article not of the nature, quality, and substance of the article of food demanded by the purchaser, a policeman named Kelway. Police-superintendent Mayne produced the certificate of Mr. M. Adams, Analyst for Kent, which was to the effect that the article was not butter at all, but was a substance made to resemble butter, and that it contained nothing unwholesome. Mr. Wood stated that the article was butterine, and was intended for cookery purposes, and was so labelled in his shop, but his assistant in his absence omitted to tell the purchaser that the article was butterine on his asking for butter. The Bench imposed a fine of £5 and 15s. costs.

"Normandy Roll Butter."—Mr. William Nettleton, grocer and provision dealer, Northgate, Huddersfield, and who has a stall in the Market Hall, appeared before the Borough Magistrates to answer a charge of having sold a pound of some article as butter which was not of the nature, substance and quality as demanded by the purchaser. The evidence for the prosecution showed that the defendant's assistant at his stall in the Market Hall sold to a youth named Liversedge, who had been sent by Mr. E. G. Kirk, the Sanitary Inspector, a pound of roll butter, which was taken from a quantity labelled "Normandy roll," telling him, however, that he could not guarantee that it was all butter. Mr. Jarmain, the Borough Analyst, found that the sample submitted to him was mainly composed of foreign fat, and was really an article known as "butterine." The question was whether the article usually known in the trade and by the public as "Normandy roll" was a pure butter. Evidence was given by several provision merchants that there was a pure butter known by that name. The defendant called a witness, who said he had been in the provision trade twenty-seven years, and did not know till three years ago that there was a butter called "Normandy roll." The Bench ordered the defendant to pay a fine of 10s. and costs, adding, however, that they did not think the defendant had wilfully offended against the law.

Adulterated Milk.—Joseph Smith, Braunston, was charged at the Daventry Petty Sessions, with selling adulterated milk. Inspector Phenix said he called at the defendant's house on the 6th of May. He saw defendant's wife, and asked her if she sold milk. She replied, "Yes." He said, "Then I'll have half a pint of new." She gave him some, and said, "This is what we sell for new." He said, "I am purchasing under the Act, and want it for analysis." She said, "This has been skimmed once, but you can have that that has not if you choose." He said he would rather have that, and she fetched him a fresh lot. He then divided it into three parts. One he left with Mrs. Smith, one he retained, and the other, numbered 32, he took to Dr. Emmerson on the 8th, and now produced the certificate of the analysis, which stated there was 10 per cent. of water. The defendant said he was not a milk seller, and called his wife to state the case for him. Mary Ann Smith said the inspector asked for some new milk, which she does not sell, but she thought he wanted some to drink, and she told him the milk had been set some time, and should not be disturbed, but to oblige him she would let him have some. She put no water to it except the swillings of the buckets, which they always did to make the cream rise. There was about a pint and a half to between three and four gallons of milk. The Bench did not consider this to be a case of deliberate fraud on the public. If parties wish to set the milk for making butter, it should be kept apart from milk to be sold. The fine would only be 1s. and costs 10s. 6d. The defendant and others should be warned.

John Goode, was charged before the Biggleswade (Beds) Bench, with having sold a quart of adulterated milk to Supt. Bedlow, the Inspector under the Act. The defendant failed to prove the purity of the milk, although he sought the analysis of a medical man as against that of the County Analyst, who said that the milk contained 24 per cent. of water. A fine of £5 and costs was inflicted.

Butterine and Milk.—Jenkins Jones, cowkeeper, of 3, Teesdale-street, Hackney, and Henry Kennedy, dairyman, of 189, Cassland-road, South Hackney, appeared at Worship-street, to summonses, taken out by the sanitary authorities of South Hackney, charging them with selling milk adulterated with water. Jones was fined 10s. and costs, and Kennedy 20s. and costs.

Joseph Coon, of 2, Fashion-street, Spitalfields, shopkeeper, was fined 60s. and 2s. costs, on the complaint of the sanitary authorities of Christ Church, Spitalfields, for selling as butter an article containing 70 per cent. of "foreign" fat, the certificate also stating that it was doubtful if there was any real butter in the composition.

At the Wolverhampton Police-court, John Lilley, grocer, and also a member of the Wolverhampton Corporation, was summoned for selling a quantity of coffee mixed with chicory. Mr. Underhill, Town Clerk, prosecuted on behalf of the Corporation, and Mr. Stirk defended. Mr. Underhill, in opening the case for the prosecution, said it was an extremely simple one. Mr. Dawson, the Inspector for the

Corporation, sent a person named Williams into the defendant's shop on the 17th April to purchase half a pound of coffee. Dawson was standing outside the shop window at the time, and saw Williams supplied with a half-pound tin of coffee, which he brought to Dawson, who told him that was not what he wanted, and he required some to be weighed up. Williams returned to the counter and told the assistant what he required, and he was then served with another lot, and when about to leave, Mr. Dawson joined him, and told the assistant that he was going to have the coffee analysed. The assistant replied that what had been supplied to Williams was genuine coffee. Mr. Dawson then divided the coffee into three lots, leaving one with the assistant, taking one to Mr. Jones, the County Analyst, and retaining the third portion himself. Mr. Jones, in his certificate, stated that the sample of coffee contained 20 per cent. of chicory. Mr. Lilley was entitled to sell coffee mixed with chicory, but he must put a label to that effect on the paper in which it was wrapped. Mr. Jones, the analyst, stated that 20 per cent. was not a large adulteration; the sum of 10d. was, however, a large price for half a pound of coffee. For the defence, Mr. Stirk said he could, if he chose, raise a technical objection which would completely upset the prosecution; but at his client's request he would not do so, but meet the case fairly and straightforwardly. Mr. Lilley was engaged in a large wholesale business in addition to having two retail shops. For the sale of ground coffee he kept a canister, divided into four compartments. Each of these compartments was used for various qualities of coffee, and a porter he kept was instructed to fill up these compartments as coffee was sold from them. In filling up these compartments, the porter might make a mistake, and put the genuine coffee into a compartment intended for a mixture of coffee and chicory, and put the mixed coffee and chicory into the compartment set apart for genuine coffee. Mr. Lilley was then called, and, in answer to the Bench, he said the mistake had been made by his porter. After briefly consulting together, the Mayor said the Bench were unanimous in their decision. They considered that Mr. Lilley's arrangements in his shop were not so satisfactory as they might be, and they suggested that he should improve them in some way. Defendant would have to pay a fine of £5 and costs.

Adulterated Butter.—At Marlborough Street, Mrs. Elizabeth Treleaven, provision dealer, Moor Street, was summoned before Mr. Mansfield by Mr. Angels Crisp, Inspector of Nuisances for the Strand District Board of Works, for selling adulterated butter. The butter having been proved to be largely adulterated, Mr. Mansfield, in fining the Defendant 10s. and costs, remarked that the persons who supplied small tradesmen with adulterated butter were the persons who should be proceeded against, as they made the largest profits by these impositions. This makes the fourth case of a similar character within about a week.

At the Lambeth County Court, recently, the case of Styles *v.* Baker was heard. The plaintiff claimed £6 for milk supplied. The son of plaintiff, a wholesale milk-dealer, of Vassall Road, Brixton, proved the delivery of the milk. Mr. Cosedge, who appeared for the defence, said his client took a sample of the milk to the sanitary authority of the Lambeth Vestry, by whom it was handed over to Dr. Muter, for analysis, and he certified that the "milk" was adulterated with 20 per cent. of water. But for the reasons which the doctor stated in his report, he did not advise proceedings to be taken until another sample of the milk had been analysed. In answer to his Honour, Mr. Cosedge admitted that his client had not paid for the last week's supply, which formed the ground of the present action, and his Honour gave judgment for the plaintiff, with costs and short order.

Adulterated Coffee.—At the South Staffordshire Stipendiary's Court, Joseph Meddings, grocer, Bilston, was summoned for selling adulterated coffee. Mr. Vaughan appeared for the defendant. Samuel Toy, assistant to Mr. Horder, stated that on May 27th he visited the defendant's shop and purchased a quarter of a pound of coffee, and informed the servant who supplied him that he was going to have it analysed. In answer to the Bench, witness said he paid 4d. for the coffee. Witness, continuing, said the servant spoke to Mrs. Meddings, and the latter then said the article was a mixture of chicory and coffee. In reply to Mr. Vaughan, witness said that by Mrs. Meddings' directions, after he had told the servant his purchase had been made for analysis, the servant wrapped the coffee in a paper on which was a printed intimation that the contents included a quantity of chicory. Mr. Horder submitted the certificate of the County Analyst, which stated that the coffee was adulterated with 85 per cent. of chicory. Mr. Horder added that pure coffee could be supplied at 1s. 4d. per pound, whilst chicory was about 5d. per pound. Mr. Vaughan contended that the charge ought not to have been brought into court, inasmuch as the defendant was shielded against the charge by the coffee being wrapped in the printed paper. The wife of the defendant stated that immediately Toy asked for the coffee she told the girl in the shop to reach a paper marked "chicory and coffee," and the coffee was wrapped in one of these, witness again reminding Toy of the fact when he said the coffee would be analysed. They sold some coffee at 1½d. for two ounces. The Deputy Stipendiary remarked that he should think the coffee at 1½d. for two ounces was all chicory. He, however, felt a difficulty in deciding the question which was raised by the defence set up, and he would therefore postpone his judgment.

At the adjourned hearing, held on the 18th July, Mr. Dallow appeared on behalf of the county authorities for the prosecution, and Mr. Vaughan for the defendant. Mr. Dallow obtained permission to make some observations on a question of law as to whether the sample was sold to the prejudice of the purchaser. He called attention to the fact that this was a sample of chicory adulterated with coffee instead of otherwise, and was sold at the rate of pure coffee. If a person bought a mixture at a high price he was entitled to a fair mixture, which was not so in the present case. In reply, Mr. Vaughan said the defendant took the precaution to put the word "chicory" before the word "coffee" on his label. It was sold as a mixture, but if too much money was paid for it that was the fault of the purchaser. In giving his decision, Mr. Haden Corser (the Deputy Stipendiary) said it appeared that Mr. Horder's assistant knew at the time he bought the sample that it was a mixture. He had not to inquire into the proportions of the mixture, because it was not for him to state what trade profits should be realised. If people chose to deal with those who made large profits, that was their own fault. After giving the case his most careful consideration he had come to the conclusion that he must dismiss the summons. Mr. Dallow made an application for the case to be argued in a superior court, and the magistrate granted the request.

Adulterated Butter.—At the Bow Street Police Court, Thomas Dodd, 27, Duke Street, Bloomsbury, was fined 40s. and 4s. 6d. costs for selling adulterated butter. The article was purchased at 1s. 4d. per lb. by an excise officer, who stated afterwards that it would be analysed. The shopkeeper then exhibited a printed intimation of the fact that it was sold as a "compound," but it was in such small type that Mr. Vaughan considered it an evasion rather than a compliance with the Act, for it almost needed a microscope to read it; besides which the fact should have been stated at the time the purchase was being made.

Adulterated Butter.—At the Gosport (Hants) Police Court, John Petman, grocer, of High Street, was summoned for selling to Police-sergeant Abraham, to his prejudice, an article which was not of the nature, substance, and quality demanded. Mr. George Feltham defended. The police-sergeant purchased three-quarters of a pound of (so-called) butter at defendant's shop, and the article was analysed by the County Analyst, Mr. Angell, who certified that it consisted of 98 per cent. of fat other than butter fat. Mr. Feltham said he had submitted some of the butter to the analysis of Dr. Turner, analyst of the Borough of Portsmouth, and his testimony was the same as the County Analyst, so he must plead guilty to the offence. His client, however, who had been in business many years, was perfectly innocent in the matter, having purchased the butter in the ordinary way of business from a merchant in Portsmouth, who had obtained it from the shippers in France. If the Bench would allow his client to have the butter which was left out of the purchase, he would bring an action against the merchants. The Bench said it was perfectly competent for the defendant to have taken a warranty with the butter, and Mr. Feltham replied that his client had unfortunately omitted to do that. The magistrates, taking all the facts into consideration, imposed a fine of 10s. and 18s. 6d. costs.

"Fraudulently Increasing Bulk."—At Faringdon Petty Sessions, Mr. George Liddiard, grocer, of Faringdon, was charged with having sold to Stephen Sheppard half a pound of coffee which was not of the nature, substance, and quality of the article demanded. Mr. Haines appeared for the defendant. It was shown that Sheppard, a constable at Reading, acting under the instructions of the Chief Constable, went to the defendant's shop in plain clothes, and asked for half a pound of coffee. The coffee was weighed out, wrapped up in paper, and delivered to him across the counter. The constable then requested the assistant who had served him to call his employer, the defendant, which he did, when the constable informed him that he had purchased the article with the intention of submitting it for analysis, and offered to divide it into three portions, and give the defendant back one portion, so as to allow him an opportunity of having that portion analysed on his own behalf. This the defendant did not require him to do, and he then called the purchaser's attention to a printed label affixed to the outside of the package, bearing the words, "This is sold as a mixture of coffee and chicory." The constable replied that he did not ask for coffee and chicory, but for coffee only. The article was afterwards submitted to the county analyst, Mr. Donkin, who certified it to contain forty parts of chicory with sixty parts of coffee. Mr. Haines, for the defendant, submitted to the magistrates that as a printed label had been delivered to the purchaser with the coffee, stating that it was sold as a mixture, the case against the defendant must be dismissed, as he had complied with the requirements of the Act, which provided that no person should be convicted of the offence charged, if at the time of sale he delivered with the article a label describing it to be mixed. The magistrates retired to consider their decision, and then stated that considering the extent to which the coffee was mixed with chicory—40 per cent.—and that the price paid for it was the usual price for unadulterated coffee, they were of opinion that the article was mixed with intent fraudulently to increase its bulk within the meaning of the Act of Parliament, which took the case out of the protection afforded to the seller by the section referred to by Mr. Haines, and they convicted the defendant in the penalty of £5, and £1 0s. 6d. costs. The defendant paid the amount, but Mr. Haines applied for a case for the opinion of a superior court. The magistrates said they could have no hesitation in granting this.

Adulterated Mustard.—At the Wantage Petty Sessions, on July 16, before Rev J. F. Collins (Chairman), T. L. Goodlake, and E. H. Morland, Esqs., Mr. E. Radbone, of Oxford, the proprietor of the "King Alfred's Grocery Warehouse" in Wantage, was charged with selling to Police-constable Sheppard, and to his prejudice, a quarter of a pound of mustard, which was not of the nature, substance, and quality demanded. Mr. L. Jotcham prosecuted; Mr. Radbone conducted his own defence. Stephen Sheppard stated that acting under orders from Colonel Blandy, the Chief Constable of the county, he went to defendant's shop on May 23rd and asked for some mustard. Mr. Blades (defendant's manager) served him, and inquired what sort he would have, naming the prices; he said he would have a quarter of a pound of that at 1s., the lowest of the prices named by Blades. It was wrapped up in a coloured wrapper, on which, among numerous other printed matter, were these words: "In the preparation of this condiment no injurious ingredient has been used." When he had paid for the mustard he told him for what it was wanted, and divided it into three parts, giving Mr. Blades one, and handing the remaining two to the superintendent of police. Mr. Blades did not say anything about it being a condiment when weighing it up. Superintendent O'Neill proved sending one of the samples to the County Analyst, and produced that gentleman's certificate that the mustard was adulterated with 40 per cent. of flour and turmeric. Mr. Radbone admitted that it was adulterated, but contended that it was sold as a condiment, and that that fact, together with it being labelled, protected him. He then called Alfred Blades, who deposed that when he was wrapping up the mustard the police-constable said to him, "Do you sell this as mustard?" He said, "No; I sell it as a condiment, which information you will find on the wrapper." Cross-examined by Mr. Jotcham: Cantell, another assistant, was in the shop, and heard all that passed. The transaction lasted about five minutes. The policeman asked for tea and mustard. The mustard was taken from the bulk in a drawer. Any customer who wanted a small quantity of mustard would have it supplied in the yellow paper. The printed part of the paper would be outside the mustard when wrapped up. Cantell, who had not heard any of the evidence, was then sent for, and corroborated the evidence of Mr. Blades as to his having informed the policeman it was a condiment when weighing it up. When the policeman was asked what mustard he would have, he said the cheap. Cross-examined: He was busy serving other customers, and did not take a lot of notice of what was going on. Customers were continually coming in and out. He did not know what made him listen on this occasion. It was nothing unusual for a man to purchase a quarter of a pound of mustard. By Mr. Goodlake: It was the policeman's tone in asking whether it was pure mustard that attracted his attention. The policeman was recalled, and stated that there were two weighings, and it was on the second weighing, to divide the mustard into three lots (after Mr. Blades knew what the mustard was wanted for), that he was informed it was a condiment. Cantell was also recalled, and said he thought it was at the second weighing; but Mr. Blades was positive as to having told the constable it was a condiment before it was purchased. The Bench dismissed the case.

Forty per Cent. of Arsenic in French Chalk.—On July 9th, Mr. Hill, Deputy-Coroner for Huddersfield, held an inquest on the body of Hetty Blackburn, aged 31 years, the wife of William Blackburn, of Marsh. The evidence showed that the deceased was pregnant, and as she suffered from heartburn her husband went on June 28th to the shop of Mr. T. N. Swift, chemist, Cross Church Street, and ask for some prepared chalk. Mr, Swift did not ask what it was required for, but thinking it was for a similar purpose to that for which chalk is used by shoemakers, supplied French chalk from a box containing a portion of a large quantity which he purchased from the Ultramarine Company, of Manchester, two years ago. The deceased took some of the chalk, and was subsequently seized with vomiting. On June 30th, Mr. D. Wilson, surgeon, of Paddock, was called to see the deceased, and found her in labour and vomiting, and she was delivered of a child, which was born alive about 35 minutes after his arrival. On Tuesday she seemed easier, but on Wednesday she died. As Mr. Wilson suspected poisoning, the police took possession of the box from which Mr. Swift supplied the chalk, and it was found by Mr. Jarmain, borough analyst, to contain 40 per cent. of arsenic. By direction of the coroner, after the inquest had been opened last Friday night, Mr. Wilson, surgeon, made a *post-mortem* examination of the body of the deceased, in the presence of Mr. Jarmain and Mr. Knaggs, surgeon, and the medical men came to the conclusion that death was the result of arsenical poisoning. Mr. Jarmain examined the contents of the deceased's stomach and found arsenic. Mr. Swift now stated that had he known the chalk contained arsenic he should not have sold it at all, and that as it was, had he known Blackburn required the chalk for medicinal purposes he should have sold him another article altogether. The jury returned a verdict that the deceased died by misadventure, but recommended Mr. Swift to be more particular in future in selling exactly what was asked for, and that the question should be asked of the purchaser what the particular article was intended for, because although French chalk might not be poisonous, it would not be altogether wholesome. The deputy coroner trusted that Mr. Ward, the chief constable, would inquire further into it. Mr. Ward said he would do so at once. Mr. Swift said he should be happy to supply any quantity of the powder he had left, and stated that he had tried to get some analysed by the Chemists' Society at Birmingham, but they had sent the sample back, saying the society did not undertake to appear in police cases. The deputy coroner said the jury did not think there was anything criminal or negligent in the case sufficient to justify criminal proceedings.

NOTES OF THE MONTH.

We call the attention of our readers to the very interesting communication from Dr. Blake White, the Inspector of Milk, of New York, giving the results of the analysis of the milk of cows undoubtedly placed in a most unsanitary locality, and fed on the most undesirable materials. This letter is the more interesting to us, as Public Analysts, because it proves that the limit of solids not fat (9 per cent.), fixed by our Society as the lowest valuation of any sample of mixed milk, holds good even when such extreme tests of bad food and unhealthy lodgings are applied. The lowest point reached by these cows is 9·01 solids not fat, and yet we hear every now and then of the limit of 8·5 being applied, because in one or two isolated cases single cows have given milk said to be as low as that. It is a certainty that, for one sample of genuine mixed milk, which falls even so low as 9, there are hundreds which mark at least 9·3; and it is, therefore, a painful but certain fact that, judging by the 8·5 limit, every milk vendor in the kingdom can, with perfect impunity, put in 10 per cent. of water, and often more, and yet the analysts, constrained by those in authority, are compelled to certify the article as genuine, when they well know to the contrary. Of course no milk can be honestly judged by the solids not fat alone in cases where there is excess of fat; but our remarks apply to ordinary well-balanced samples, and we hold that, in such cases, the limit should be 9 per cent., as giving quite sufficient margin to any honest cow-keeper. It is almost a pity that, in fixing a limit for spirits, the legislature did not also enquire into the milk question, when we are satisfied the great mass of scientists, who make a speciality of food, would have supported our Society's limit, and made it illegal to sell milk under 9 solids not fat, without declaring it at the time of purchase.

Some wonderful instructions for the quantitative analysis of milk have lately been published in the *Dairyman*, which, by the way, is now known as the *Provisioner*. Here is that authority's receipt for making Fehling's solution—

> "The standard copper solution is prepared by dissolving 34.65 *grains* of crystals of cupric sulphate in 200 c.c. of water. To this solution is added a solution made by dissolving 173 *grains* of potassio-sodic tartrate (Rochelle Salts) in 480 c.c. of sodic hydrate of specific gravity 1.14. The whole is diluted till it occupies the volume of *one litre*. The standard solution, so prepared, is of such a strength that 10 c.c. are equivalent to 0.067 *grains* of milk sugar (dry at 100° C)."

The mixture of the English and metrical systems of weight and measure contained in the above is at once startling and amusing.

We are indebted to the *Pharmaceutical Journal* for the following:—"M. Carles recently called the attention of the Bordeaux Pharmaceutical Society to the presence in commerce of quinine containing an exaggerated quantity of water. A sample examined lost 17 per cent. of water when dried at 100° c., or 5 per cent. in excess of the normal quantity. The same sample was found to contain a quantity of quinidine. M. Dambier said that he had recognised the same fact several times in sulphate of quinine obtained from good houses."

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
4595	C. F. Heinrichs	Apparatus for Generating Electric Currents	10d.
4626	St. G. L. Fox	Electric Lighting	8d.
4645	J. S. Sellond and W. Ladd	Obtaining Electric Light	6d.
4662	J. T. Sprague	Producing Electric Light	6d.
4762	Ditto	Apparatus for Generating Electric Currents	8d.
4671	W. L. Scott	Production, &c., of Electric and Electric Calcic Lights	6d.
4693	A. Reimenschneider and F. S. Christensen	Apparatus for Dividing Electric Light	4d.
4700	A. Miller	Manufacture of Illuminating Gas	6d.
4705	F. J. Cheeseborough	Distributing Electric Currents for Lighting, &c.	1s.
4847	Ditto	Electric Lamps	8d.
4737	A. Cahen	Manufacture of Salts of Soda	6d.
4762			
4774	L. L. Pulvermacher	Producing Light by Electricity	6d.
4844	Ditto	Dynamo Electric Machine for producing Electric Currents	6d.
4812	F. W. Vogel	Machinery for Generating Electricity	2d.
4813	G. Scarlett and C. Hayward	Electric Magnetic Engines	2d.
4821	R. Sabine	Electric Lamps or Regulators	2d.
4862	A. Ashby	Softening Water	4d.
4955	E. Johnson and L. Robertson	Apparatus for Generating Chlorine Gas	2d.
4960	A. V. Newton	Apparatus for producing Electric Light	10d.
4988	S. P. and W. P. Thompson	Production of Electric Light	2d.
5011	S. Cohné	Electric Candle	2d.
5044	J. H. Johnson	Electric Lamps	2d.
5053	Ditto	Apparatus for Lighting by Electricity	2d.
5057	C. D. Abel	Manufacture of Pyroxyline	6d.
5152	G. Whyte	Electric Lamps or Lights	6d.
5159	R. V. Tuson	Preparation of Sulphurous Acid Gas	2d.
5165	A. M. Clark	Electric Lamps	4d.
5183	W. R. Lake	Electric Lighting Apparatus	8d.
5197	H. Wilde	Ditto ditto	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; Annual Announcement of the Faculty of Medicine of McGill University, Montreal; Annual Report of the Smithsonian Institution, *New* York; Ammonia Liquor Tests, by F. W. Hartley.

THE ANALYST.

SEPTEMBER, 1879.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on the 22nd August, at the Literary and Philosophical Society, Sheffield, Mr. G. Jarmain in the chair.

The minutes of the previous meeting were read and confirmed.

On the ballot papers being opened it was announced that Mr. W. F. H. Pocock, Analytical Chemist of Cape Town, Cape of Good Hope, had been elected a Member.

The following papers were then read :—

"A Suggestion Respecting the Expression of the Results of Butter Assays by Dr. Koettstorfer's Method," by A. H. Allen, F.C.S.

"The Relation Between Dr. Koettstorfer's Process of Butter Analysis and the Old Processes," by G. W. Wigner, F.C.S.*

"Note on the Quality of the Paper Employed by the Daily Press," by A. H. Allen, F.C.S.

"On the Difference in Milk Between the Beginning and End of a Delivery," by J. Carter Bell, F.C.S.

NOTE ON THE QUALITY OF THE PAPER EMPLOYED BY THE DAILY PRESS.

By Alfred H. Allen, F.C.S.

Read before the Society of Public Analysts, at Sheffield, on 22nd August, 1879.

Some two years since I had occasion to inquire into the quality of the paper supplied to a well-known daily paper, and I then incidentally examined the paper employed for various prominent newspapers, with the aim of ascertaining whether the paper in question was better or worse than the generality.

The plan of inquiry adopted was a very simple one. A strip of paper one inch wide and twelve inches long was cut from the edge of the newspaper. It was then well dried in a water-oven, and its weight taken. This was calculated to the square foot of paper. The strip of paper was then burnt, and the ash weighed. This weight was calculated to a percentage of the weight of the original strip.

The following table shows the results yielded by the leading daily papers. The papers are arranged in the order of their quality, as measured by the weight of the paper less that of the ash. This plan gives an approximation to the amount of the fibre, but of course the results are nothing more than rough comparisons as the quality of the paper is liable to accidental variation from several causes.

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* We are compelled to hold over this paper until our next number.—Eds. Analyst.

		Weight of Paper in grains per square foot.		
	Name of Paper.	Total Weight.	Exclusive of Ash.	Percentage of Ash.
1.	Morning Post	110·4	104·1	5·7
2.	Times	90·5	77·7	14·1
3.	Pall Mall Gazette	94·2	76·8	18·4
4.	Birmingham Daily Post	82·2	75·1	8·6
5.	Daily Telegraph	71·1	66·5	6·4
6.	Plymouth Post	68·8	65·2	5·4
7.	Sheffield Daily Telegraph	71·3	63·0	11·5
8.	Bristol Daily Post	67·7	62·5	7·6
9.	Daily News	67·7	61·0	10·0
10.	Western Morning News	68·7	61·0	11·4
11.	Standard	71·1	60·2	15·3
12.	Globe	69·8	59·1	14·2
13.	York Herald	65·5	58·5	10·8
14.	Manchester Guardian	64·1	58·2	9·2
15.	Leeds Mercury	63·7	57·3	10·1
16.	Manchester Examiner	67·7	56·4	12·9
17.	Liverpool Daily Post	59·3	56·2	5·1
18.	Echo	68·7	56·0	18·3
19.	Yorkshire Post	64·2	54·4	15·4
20.	Liverpool Mercury	60·8	53·3	12·3
21.	Sheffield Independent	62·5	51·7	17·4
22.	Western Daily Press	58·3	50·1	14·0

These results clearly show, as might have been expected, that the *Morning Post* and *Times* papers are heavier and stronger than those employed for the penny press. The difference between the ash of these two papers is, however, somewhat striking, and other curious points will occur to anyone inspecting the figures.

The weight and percentage of ash of paper furnish the usual commercial tests of quality, and although these factors are not the only ones which should be taken into account in forming an opinion, they are of considerable importance, and hence the figures recorded may be of service to chemists engaged on similar inquiries, as they show what newspaper should contain. Other things being equal, the paper will be better the greater its weight per square foot. The ash, of course, indicates so much mineral matter added to give weight, substance, and surface; and, as it does not add to the strength, it should be deducted before making a comparison of the quality.

The determinations recorded in the table were made in my laboratory by Mr. Charles Harrison.

I may add that the colouring matter which gives the *Globe* its roseate hue is aniline red. It may readily be dissolved out of the paper by alcohol.

A SUGGESTION RESPECTING THE EXPRESSION OF THE RESULTS OF BUTTER ASSAYS BY DR. KOETTSTORFER'S METHOD.

By A. H. Allen, F.C.S.

Read before the Society of Public Analysts, at Sheffield, on 22nd August, 1879.

I have been much interested in perusing the description of Dr. Koettstorfer's method of detecting foreign fats in butter, and have no doubt that experience will prove it to be extremely useful. It appears to me, however, that his mode of stating the neutralizing power of the fats is very cumbrous, and has the disadvantage that if soda be used for saponification instead of potash a different amount of it will be necessary, and hence the relation between the results obtained will not be directly evident. As the simplicity and accuracy of Dr. Koettstorfer's process are likely to bring it into very general use, I propose, that instead of stating the results in milligrammes of K H O used per gramme of fat, they should be expressed by figures representing the combining equivalent of the fats present. These will in each case be one-third of the molecular weights of the fat, owing to the triad character of the glycyl radical.

Thus, 56·1 parts of K H O will theoretically saponify 296·7 parts of tri-stearin; 292·0 parts of tri-olein; 296·0 parts of tri-palmitin; or, 100·67 parts of tri-butyrin.

Dr. Koettstorfer's results are capable of translation into equivalents, by dividing the milligrammes of K H O employed into the number 56·1.

By so doing, we find that the average equivalent weights of the animal fats tested by Dr. Koettstorfer were as follows:—

Beef dripping	285.5
Commercial tallow	285·1
Lard from kidneys	286·5
Lard from unsmoked bacon	286·7
Commercial lard	287·1
Mutton dripping	284·8
Average =	286

Calculating in the same manner, his results show 292·5 as the equivalent of olive oil, and 313·9 as that of colza oil.*

On the other hand, the equivalents of the thirteen samples of butter varied from 253·3 to 241·4, the average being 247·1.

Hence, average butter fat has an equivalent lower by 39 than the average of animal fats. Dividing this difference by 100, we find that every rise of ·39 in the equivalent of the sample represents 1 per cent. of *probable* adulteration; but, of course, though these figures may be properly used for calculating the probable proportion of admixture, a butter should not be condemned unless its equivalent be found to exceed 255.

By expressing the results of analysis in equivalents, it is evident that it becomes a matter of indifference whether soda or potash be used for saponification. It will be noticed that the expression in equivalent weight is at once obtained by dividing 1·000 by the number of c.c. of normal alkali required to saponify one gramme of the fat under examination.

ON THE DIFFERENCE IN MILK BETWEEN THE BEGINNING AND END OF A DELIVERY.

By J. Carter Bell, F.C.S.

Read before the Society of Public Analysts, at Sheffield, on 22nd August, 1879.

It has been stated to me by milkmen and others, that the last few pints of milk from a can which has been carried about in a cart are not so good as the milk before it begins its journey. This absurd statement has on more than one occasion been made before the magistrates, who are rather inclined to believe the story. Having just had an adulterated sample of milk, the usual excuse was put forward: "Last in the can."

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* The high equivalent of colza oil, if confirmed by further experiments, points to the presence of a higher homologue of stearic or oleic acid in this product.

To settle this point, I asked the Inspector to travel with the cart, and to take a sample on starting, another in the middle of the journey, and a third at the end. It will be seen by the analyses that practically speaking there is no difference.

No. 1. Taken at 5.30 p.m., commencement of journey—

Total solids, by weight	12·49
Solids not fat	8·94
Fat	3·55
Ash	·73

No. 2. Taken at 7 p.m.—

Total solids	12·56
Solids not fat	9·02
Fat	3·54
Ash	·73

No. 3. Taken from last in can, 8.30 p.m.—

Total solids	12·57
Solids not fat	8·98
Fat	3·59
Ash	·70

SALE OF FOOD AND DRUGS ACT AMENDMENT ACT, 1879.

The following is the full text of this Act, to which the Royal Assent was given on the 21st July last, and which we presume came into operation at once:—

38 & 39 Vict. c. 63.

Whereas conflicting decisions have been given in England and in Scotland in regard to the meaning and effect of section six of the Sale of Food and Drugs Act, 1875, in this Act referred to as the principal Act, and it is expedient, in this respect and otherwise, to amend the said Act: Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

Short title.

1. This Act may be cited for all purposes as the Sale of Food and Drugs Act Amendment Act, 1879.

In sale of adulterated articles no defence to allege purchase for analysis.

2. In any prosecution under the provisions of the principal Act for selling to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality of the article demanded by such purchaser, it shall be no defence to any such prosecution to allege that the purchaser, having bought only for analysis, was not prejudiced by such sale. Neither shall it be a good defence to prove that the article of food or drug in question, though defective in nature or in substance or in quality, was not defective in all three respects.

Officer, inspector, or constable may obtain a sample of milk at the place of delivery to submit to analyst.

3. Any medical officer of health, inspector of nuisances, or inspector of weights and measures, or any inspector of a market, or any police constable under the direction and at the cost of the local authority appointing such officer, inspector, or constable, or charged with the execution of this Act, may procure at the place of delivery any sample of any milk in course of delivery to the purchaser or consignee in pursuance of any contract for the sale to such purchaser or consignee of such milk; and such officer, inspector, or constable, if he suspect the same to have been sold contrary to any of the provisions of the principal Act, shall submit the same to be analysed, and the same shall be analysed, and proceedings shall be taken, and penalties on conviction be enforced in like manner in all respects as if such officer, inspector, or constable had purchased the same from the seller or consignor under section thirteen of the principal Act.

Penalty for refusal to give milk for analysis.

4. The seller or consignor or any person or persons entrusted by him for the time being with the charge of such milk, if he shall refuse to allow such officer, inspector, or constable to take the quantity which such officer, inspector, or constable shall require for the purpose of analysis, shall be liable to a penalty not exceeding ten pounds.

Extension of Act as to sale in streets, &c.

5. Any street or open place of public resort shall be held to come within the meaning of section seventeen of the principal Act.

Reduction allowed to the extent of 25 degrees under proof for brandy, whisky, or rum, and 35 degrees for gin.

6. In determining whether an offence has been committed under section six of the said Act by selling, to the prejudice of the purchaser, spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that such admixture has not reduced the spirit more than twenty-five degrees under proof for brandy, whisky, or rum, or thirty-five degrees under proof for gin.

Extension of meaning of "county."

7. Every liberty having a separate court of quarter sessions, except a liberty of a cinque port, shall be deemed to be a county within the meaning of the said Act.

Quarter sessions boroughs not to contribute to county analyst.

5 & 6 W. 4. c. 76.

8. The town council of any borough having a separate court of quarter sessions shall be exempt from contributing towards the expenses incurred in the execution of the principal Act in respect of the county within which such borough is situate, and the treasurer of the county shall exclude the expenses so incurred from the account required by section one hundred and seventeen of the Municipal Corporation Act, 1835, to be sent by him to such town council.

Provision for boroughs with separate police.

9. The town council of any borough having under any general or local Act of Parliament, or otherwise, a separate police establishment, and being liable to be assessed to the county rate of the county within which the borough is situate, shall be paid by the justices of such county the proportionate amount contributed towards the expenses incurred by the county in the execution of the principal Act by the several parishes and parts of parishes within such borough in respect of the rateable value of the property assessable therein, as ascertained by the valuation lists for the time being in force.

Special provision as to time for proceedings.

10.—In all prosecutions under the principal Act, and notwithstanding the provisions of section twenty of the said Act, the summons to appear before the magistrates shall be served upon the person charged with violating the provisions of the said Act within a reasonable time, and in the case of a perishable article not exceeding twenty-eight days from the time of the purchase from such person for test purposes of the food or drug, for the sale of which in contravention to the terms of the principal Act the seller is rendered liable to prosecution, and particulars of the offence or offences against the said Act of which the seller is accused, and also the name of the prosecutor, shall be stated on the summons, and the summons shall not be made returnable in a less time than seven days from the day it is served upon the person summoned.

THE LOCAL GOVERNMENT BOARD AND THE SALE OF FOOD AND DRUGS ACT, 1875.

The Local Government Board have just issued their Annual Report for 1878, and from it we extract the following :—

"In our last report we stated that we had addressed communications to all those authorities from whom we had not received any intimation of an analyst having been appointed, calling attention to the provisions of The Sale of Food and Drugs Act, 1875, and requesting that, if an analyst had not been appointed under it, or under any of the statutes which it repealed, the subject might receive early consideration. The result of these communications, has, so far, been satisfactory, for whereas in the year 1877 analysts were appointed, under section 10, in twenty-seven additional cases, during the year ended the 31st of December last forty-three additional appointments were reported to and approved of by us. Three authorities also availed themselves of the provisions of section 11, and entered into agreements with the County Analyst, or with the analysts for neighbouring boroughs, to act in a similar capacity for their boroughs.

"Up to the above-mentioned date the number of authorities who had appointed analysts under section 10, with our approval, the appointments being then in existence, is as follows:—

Counties	49
Boroughs	108
District Boards and Vestries in the Metropolis	39
	196
Agreements entered into under section 11	5
	201

"We are still in communication with those authorities who have not yet availed themselves of the advantages to be derived from the appointment of an analyst.

"The experience of previous years had suggested the advisability of an attempt being made to secure proximate uniformity in the quarterly reports required to be made by Public Analysts to local authorities under the 19th section of the Act, and in January we issued to authorities the circular" printed in the appendix to the report.

[This circular encloses the form of report which analysts now use.—Eds. Analyst.]

"The result has been greatly to facilitate the preparation of the abstract of these reports.

"We find that in 1878, as previously, only a small proportion of the analyses were made at the instance of private individuals, and that in many districts all the samples analysed had been procured by inspectors appointed under section 13 of the Act.

"On several occasions in previous years it had been contended before magistrates that an official purchaser, buying not for his own consumption but exclusively for analysis, and on behalf of the authority, could not be 'prejudiced' within the meaning of section 6 of the Act. This objection, however, had not generally been held valid by English magistrates, and the suggested difficulty in respect of such purchases did not arise until attention was called to a decision of the High Court of Justiciary in Scotland from which it was inferred that the terms of the 6th section might be so interpreted as practically to nullify the operation of the Act. Some remarks attributed to one of the judges of High Court of Justice in the case of Sandys *v.* Small (which, however, do not appear in the authorised report of the case L.R. 3 Q.B.D. 449), gave further colour to this assumption, and the result was that, pending an appeal on this point to the High Court at Westminster, comparatively few samples were submitted for analysis in the latter part of 1878, and even in the cases in which samples were analysed and found to be extensively adulterated, local authorities hesitated to take legal proceedings against the vendors. We regret that interruption in the working of an useful Act should have been caused by any uncertainty as to the meaning of a provision which was inserted for the special purpose of preventing a tradesman from being convicted for selling, to his own disadvantage, an article superior to that demanded.

"It is satisfactory, however, to find that notwithstanding a marked falling off at the end of the year, due to the cause we have indicated, the entire number of samples submitted for analysis in 1878, exceeds by more than 200 those analysed in the previous twelvemonth, and that the proportion of adulterated samples shows a substantial diminution.

"The first comprehensive enquiry into the prevalence of adulteration in England was that of the *Lancet* Commission in 1854-56, when considerably more than half the samples analysed were reported against. In the year 1877, when the results of the analysis under the Act of 1875, were for the first time tabulated, the proportion of adulterated samples was 19·2. In 1878 it was 17·2; and it may be further noticed that if spirits are excluded from the calculation the percentage of adulteration falls from 15·5 in 1877, to 13·7 in 1878.

"The following table shows the number of samples examined in the year, and the percentage of adulteration. It must be specially borne in mind that such percentage is based on the results of the analyses as given in the quarterly reports, and not merely upon the number of cases in which legal proceedings were instituted.

——	Examined.	Adulterated	1877. Percentage of adulteration.	1878. Percentage of adulteration.
Milk	4,923	1,065	24·1	21·6
Bread	921	66	7·4	7·1
Flour	600	11	6·0	1·8
Butter	904	116	10·8	12·6
Coffee	1,060	196	17·5	18·5
Sugar	299	13	0·4	4·3
Mustard	787	154	18·8	19·5
Pickles (including tinned Vegetables)	114	8	27·6	7·0
Jam	51	1	6·1	1·9
Confectionery..	314	16	3·3	5·0
Wine	76	2	32·2	2·6
Beer	999	50	9·3	5·0
Gin	918	432	57·7	47·0
Spirits other than Gin	791	365	47·6	46·1
Drugs	491	125	21·8	25·4
Other Articles	2,943	162	9·8	5·5
Total	16,191	2,782	19·2	17·2

"It will be seen that, as compared with 1877, there has been a decided improvement in the quality of the milk analysed, though we cannot regard it as satisfactory that, even now, more than one-fifth of the samples examined fail to reach the standard of genuineness generally adopted by analysts. That standard is necessarily low, since the present state of science does not enable the analyst to pronounce with certainty whether excess of water, down to a certain limit, is due to natural poverty of milk, or to the dilution of milk which was originally good; and thus a higher standard of excellence cannot be set up without making it possible to secure convictions under an Adulteration Act for the sale of what is perhaps the milk of ill-fed cows, but is nevertheless perfectly genuine. It is worth remarking, however, that in some instances in which the result of the examination had been such as to lead to the inference that a small amount of water had been added, although the evidence was not strong enough to warrant the adoption of legal proceedings, the vendors were informed of the suspicion attaching to them and cautioned as to the future. In one case the vendor of extensively watered milk was excused from prosecution on pleading extreme poverty, and gratefully undertook to abandon the trade of dairyman altogether. It is to be feared, however, that where, as is the case in some districts, the magistrates inflict only small fines, a good many milk-sellers find it profitable to pay the fines and continue adulteration.

"Of the bread examined it will be seen that about seven per cent. of the samples were reported against, for the most part in consequence of additions of alum by which it was sought to improve its appearance.

"Of the samples of flour, only 11 out of 600 had been similarly tampered with.

"The sale of a compound of foreign fats in place of butter seems to be somewhat on the increase. The Public Analyst for St. Giles District observes with regard to this article that 'it is more palatable than common rancid butter;' and though this amount of commendation does not suggest a high degree of attractiveness, yet, as he also states that the commodity is wholesome and nutritious, we see no reason against its use, provided it be invariably sold under a distinctive name and not fraudulently substituted for the genuine product of the churn.

"As regards coffee, the returns for 1878 show some increase of adulteration as compared with those for 1877. In the investigations made by the *Lancet* Commission, roasted corn, beans, and potato flour were found to be among the substances used to adulterate coffee, but it would appear that the employment of these substances has now been almost entirely abandoned, though mixtures of chicory and coffee are still extensively sold without due warning to the purchaser, and a new preparation of coffee mixed with roasted and ground datestones has been introduced. The practice as to the delivery of notifications of admixture, however, is by no means uniform in different parts of the country, and we remark that while in Liverpool 67 samples of so-called coffee out of 85 are found to contain chicory in greater or less proportion, the County Analyst of Gloucestershire only reports against two samples out of 71. Similarly, as regards mustard, it may be said that while some perfectly harmless and very palatable preparations of mustard are deservedly popular, they are too often sold without an intimation to the purchaser that they are compounds, and not merely mustard flour. Under the heads of pickles, jams, and confectionery respectively the returns show only a small amount of adulteration, and in very few instances was such adulteration of a character likely to be injurious to health. Of wine, only two samples out of 76 were reported against and it may be inferred that the sophistication of cheap wines is not so common as is popularly supposed. Of one of the adulterated samples in question the analyst observed that it was a 'concoction resembling nothing in particular, and called sherry,' the other was an entirely fictitious claret, coloured with magenta, and is described as 'a most unwholesome beverage.'

"Of the samples of beer it will be seen that nearly five per cent. of the whole number of samples examined were reported against, although in the Metropolitan District all but six samples were genuine out of 237. Excess of salt is the ground on which most of the samples have been pronounced adulterated, and the use of noxious ingredients seems to be now nearly obsolete. With regard to the addition of salt, there is much difference of opinion as to whether the practice prevails to any considerable extent. It is alleged on the one hand that salt is added by publicans in order to make their beer provoke rather than slake thirst, but on the other hand it is affirmed that consumers would be repelled at the onset by beer sufficiently salted to have that effect. Moreover, very different estimates appear to be made of the amount of salt that may be naturally present in beer brewed from nothing but malt, hops, water, and perhaps sugar, and to which nothing has since been added. The Analyst for Lincolnshire states that the best brewing waters contain less than 15 grains of salt per gallon, and, allowing for the chlorides natural to the malt and hops used, he considers that beer should not have more than 20 to 25 grains of salt per gallon, and he adopts 30 grains per gallon as a standard which will leave sufficient margin. Similarly the Analyst for the County of Cardigan reports against samples containing from 22½ to 33 grains of salt per gallon. On the other hand the Analyst for the Strand District states that "one sample of Yarmouth ale contained 125 grains of salt per gallon, naturally present," and the Analyst for Windsor thinks it "scarcely advisable to institute proceedings unless the common salt exceeds 100 grains per gallon." The Analyst for the District of Saint Saviour, Southwark, reports that as much as 91 grains per gallon was found in the porter of a well-known London firm of brewers, and a summons was issued on the analyst's certificate. The firm, however, gave every facility for an examination of the materials used for brewing; and it was found that the water itself contained chlorides estimated as equivalent to 48½ grains of common salt per gallon; and, considering that a gallon and a third of water is required to brew a gallon of beer, this would account for no less than 64 grains in respect of the water alone, without reckoning the not inconsiderable amount of chlorides in the malt, sugar, and hops employed. The result of this investigation was the withdrawal of the summons, as there was every reason to believe that the salt found in the porter had been derived from the legitimate ingredients used in brewing. No doubt the result of this and similar inquiries will tend to prevent analysts from assuming too hastily that the presence of an amount of salt rather above the average quantity necessarily implies that beer has been adulterated.

"Of the samples of spirits examined, it will be seen that nearly half are reported against, but it is necessary to explain that this result is due almost entirely to the practice of diluting spirits with water, and that there has been scarcely an instance of the addition of the pungent ingredients, such as capsicum and oil of vitriol, which used to be employed to stimulate strength in reduced spirits. Considerable difference of opinion, however, has existed as to the amount of dilution which should be allowed, and hence it has happened that a fine has been inflicted in one district for the sale of spirit which in another district would have been passed by the analyst as genuine. It is almost inevitable that some such difficulty should arise in the case of an article which is a compound of alcohol and water in very varying proportions. For instance, gin generally leaves the still at about 50 per cent. over proof, whereupon the rectifier flavours it, and adds water so as to bring it to about 17 per cent. under proof, at which strength, or some five degrees weaker, it is usually issued to the retailers who in their turn frequently make further additions of water. There is obviously some difficulty, in the absence of a generally recognised standard, in fixing the precise point at which a compound of alcohol and water ceases to be gin and becomes gin-and-water.

"Probably nobody could drink 'genuine' gin, if by that term is meant the spirit as it comes from the still, while if 'gin' be defined as the spirit originally sold under that name, it must be admitted that there has for a long time existed a general practice of selling, as gin, a very weak spirit at a correspondingly low price. It seems to us that there is much need of a settlement of this question by the establishment of a standard, either fixed by general agreement (if that be attainable) or by legal enactment. So long as one analyst reports gin 24 per cent. under proof as adulterated, while another reports gin 38 per cent. under proof as genuine, there will be complaints, not altogether unfounded, of the hardship caused by such anomalies.

"We have again to express regret that more samples of drugs are not submitted to analysis, for it is obvious that prescriptions may have very different effects according as they are made up with genuine or with adulterated medicines.

"An illustration of this is afforded by the report of the Analyst for the West Riding of Yorkshire, who observes that 'the dilution of sweet spirit of nitre by addition of water causes a gradual decomposition of the nitrous ether on which its medicinal value depends, thus rendering it worthless; hence the dilution of sweet spirit of nitre cannot be too strongly condemned.'

"We find that a good many of the samples examined were of violet powder, public attention having been drawn to this article by the disastrous results arising at Loughton from the use of such powder which had become mixed with large quantities of arsenic. No similar admixture was discovered elsewhere, but in several instances substances which would act as irritants rather than as sedatives were sold under the name of violet powder.

"Of the articles not specified by name in the table given above, cocoa furnishes a considerable proportion, and the Analyst for Hackney reports that some of the samples, which it is true had been labelled as mixtures, contained only from ten to fifteen per cent. of cocoa, and should have been rather described as 'arrowroot flavoured with sugar and cocoa.' He adds that this compound is comparatively useless as a food, for the quantity used for making a cup of cocoa would scarcely have greater nutritive value than a single mouthful of bread and butter. In the same district, as well as in that of Clerkenwell, occasion was taken to analyse some of the ices sold by itinerant vendors, and it is satisfactory to learn that in no case was any injurious ingredient detected.

"Summing up the evidence of the reports as a whole, we may observe that they afford proof that while the growing demand for excessive cheapness has a tendency to produce spurious imitations, yet, speaking generally, adulteration is diminishing; its character, where it exists, is much less noxious than formerly; and by the help of the Act it is possible for persons who take reasonable precautions to obtain only genuine articles of consumption."

The Customs Analysts report to the Commissioners that during 1878 they received 689 samples of tea for analysis, and of these 47 were reported to the Board as being either bad or doubtful. Seven of these were ordered to be detained as seizures, but on re-consideration 3 of them were allowed to be exported, and only the remaining 4, which represented 6 packages, were destroyed as unfit for food. Inclusive of the 3 above mentioned, a total of 19, representing 5,372 packages, were allowed to be exported—that is, we presume, were considered unfit to be consumed in England—and the *remaining* 24, representing 5,948 packages, were admitted for consumption. The number reported to the Board is only about half what it was for 1877, viz., 88, and this diminution is rightly considered to indicate that some check has been put upon tea adulteration. The principal if not only adulterant used during both 1877 and 1878 was exhausted tea leaves.

The following is a list of the total number of samples, examined and adulterated, in England and Wales, during 1878 :—

TOTAL NUMBER OF SAMPLES.

	Examined.	Adulterated.	Proportion Adulterated.	
			1878.	1877.
The Metropolitan District	4642	589	12·6	13·4
COUNTIES.				
Bedford	206	16	7·7	7·4
Berks	61	5	8·1	5·1
Bucks	4	0	0·0	0·0
Cambridge	31	8	25·8	22·7
Chester	551	154	27·9	20·6
Cornwall	15	4	26·6	39·3
Cumberland	48	30	62·5	—
Derby	109	23	21·1	31·3
Devon	74	10	13·5	28·6
Durham	510	85	16·6	31·0
Essex	7	5	71·4	57·1
Gloucester	725	57	7·8	8·2
Herts	41	6	14·6	—
Kent	289	38	13·1	0·0
Lancaster	1868	462	24·7	26·8
Leicester	278	31	11·1	18·8
Lincoln	369	98	26·5	32·7
Middlesex	147	34	23·1	12·4
Monmouth	74	25	33·7	—
Norfolk	12	4	33·3	23·2
Northampton	133	28	21·0	14·9
Northumberland	319	108	33·8	38·4
Nottingham	72	14	19·4	17·5
Oxford	15	7	46·2	72·7
Rutland	8	0	0 0	0·0
Shropshire	164	29	17·6	15·6
Somerset	1169	129	11·0	13·7
Southampton	438	115	26·2	21·4
Stafford	962	153	15·9	22·6
Surrey	535	120	22·4	12·9
Sussex	319	47	14·7	17·7
Warwick	252	57	22·6	25·4
Westmoreland	37	17	45·9	—
Wilts	84	13	15·4	—
Worcester	149	24	16·1	29·5
York, E. Riding	183	40	21·8	—
,, N. Riding	56	10	17·8	42·2
,, W. Riding	668	113	16·9	22·0
WALES.				
Anglesey	27	2	7·4	—
Cardigan	34	11	32·3	—
Carmarthen	64	18	28·1	51·2
Glamorgan	442	43	9·7	20·6
Pembroke	—	—	—	12·5
TOTALS	16,191	2782	17·18	19·2

REVIEWS.

Spon's Encyclopædia of the Industrial Arts, Manufactures, and Commercial Products.

Edited by G. G. André, F.G.S.

The first division of this work (which is published in numbers of 64 pages each at 2s.) is now complete. It contains 384 pages, carries the subject matter down to "Beverages," and is issued in a cloth-bound volume of handy size, which is not too thick and heavy for common use. In the initial notice of the book we were reminded that the great strides lately taken by chemistry had rendered previous works on the same lines comparatively obsolete; but in addition to this claim to attention the promised *Encyclopædia* was to have a still stronger *raison d'être*, from the fact that in treating the various subjects the *ultra scientific* and the *popular* styles were both to be discarded in favour of a strictly practical or manufacturing point of view. That this promise has been well carried out must be fully admitted, and, if the *status* of the present volume be maintained in its successors, we shall have in *Spon's Encyclopædia* a real addition to our standard practical literature. The division now complete commences with the acids, and includes alcohols, alkalies, alloys, alum, arsenic, asphalt, assaying, beer, and beverages generally. The most copious and practical details are given of the manufacture of the substances treated of, while the illustrations of the necessary apparatus and plant are exceedingly copious and well drawn. The various articles are stated to have been written by men actually engaged in the respective manufactures, and they certainly read as if this were so, because, not only do they discuss all the methods at present in use, but also indicate carefully the weak points of each process, and show where further improvements are still desirable. The portion on alcohol and the various improved methods for its rectification, is very interesting, and the details of gin and whisky manufacture somewhat startling to a general reader. Here, for instance, is a complete answer to the complaints of an undeserving public, that in spite of Public Analysts adulterated gin is constantly sold, as it seems that the true art of gin-making is in itself the very *acmé* of adulteration. At page 222 we read that "gin was originally imported from Holland under the name of 'Geneva,' from *Genièvre*, the French for juniper. The liquor known by this name in England, or British gin, is a very different article from that made in Holland. It consists solely of grain spirit, flavoured with *oil of turpentine* instead of juniper. Small quantities of other aromatic substances are introduced into the spirit for the purpose of hiding or 'killing' the very unpleasant taste and effects of the unrectified grain spirit. The recipes which are given in different works for the preparation of gin are wholly untrustworthy, as they yield a liquor which bears but little resemblance to true gin. Indeed, all attempts to make gin from the recipes usually found in books have invariably resulted in failure. Each distiller has his own particular recipe, and his product its own characteristic flavour and adherents; the difference between the several varieties, and especially between those of London and Plymouth, is very marked. In making gin, great care must be taken not to use an excess of flavouring. The following are good recipes for British gin:—

"(1.) Grain spirit (proof), 80 gallons; newly rectified oil of turpentine, 1¼ pint; *mix well together*: add 14 lbs. of common salt dissolved in 40 gallons of water; stir well and add 8 fluid drachms of creasote: distil over 100 gallons, or until the feints begin to rise. The product is 100 gallons of gin, 22 u.p. Half-a-pint of either rectified fusel oil or of oil of juniper may be added."

Passing over two other recipes, we come to a final one, in which among other interesting ingredients we find oil of vitriol and chilies, alum and cream of tartar being added at the last to fine. Such being the real practical receipts for gin-making, where is the bold analyst who can find any adulteration?

Perhaps the weakest point in the volume is the article on assaying, but as the writer has been limited apparently to 15 pages, in which he not only goes over all the metals, but also takes in coal, guano, gunpowder, limestone, and nitre, it is not to be expected that the matter can be carried beyond mere notes, coupled with details here and there of what the author considers to be good processes. The article would have been much increased in value if mention had been made of special works to which the reader might have been referred for fuller instructions. Viewed as a mere summary, it is well and crisply put together, but it is out of accordance with the full information given on other subjects, and it is almost a pity that a mere sketch, as it were, of chemical analysis should have been introduced at all, as very few who buy the book will require information of this kind. Taken, however, as a whole, *Spon's Encyclopædia* must be held to be a thoroughly useful work, without which no manufacturer's library will be complete, and which no student of chemistry intending to enter the manufacturing branch can afford to neglect. As a book of reference for the consulting chemist it will also have a useful place in all questions relating to works, and the more so that copies of all statutes (such as the Alkali Act) affecting any particular process will be found in their proper places.

A Systematic Course of Practical Qualitative Analysis.

By Thomas Eltoft, F.C.S.

This is another of these books of limited scope, designed for students preparing for special examinations. It has no feature of novelty, except that the usual tabular form has been departed from in the metal course, and a system of printing followed which the author specially points to in the preface; but, strangely enough, the very thing thus abandoned in the metals is adopted for the acids! The author fancies that his is "the first attempt to place the acids in systematic order and small space," but, before taking up that idea, he should have diligently searched the larger works, and he would have found that practically the same system has already been used in a more extended form. In *Muter's Analytical Chemistry*, for example, the acids are reduced to an exact course, just like the bases, by a similar "preparation of solution" and succession of re-agents to those employed in this *brochure*, but in that work many organic acids are also included, which are, of course, absent here.

Adulterated Drugs.—Dr. Cameron, Analyst for the County of Limerick, having recently reported to the Guardians of Newcastle Union that five out of seven drugs sent to him were adulterated, the Board resolved that in future all the drugs supplied to the Union should be submitted to analysis, and if adulterated the vendors prosecuted.

LAW REPORTS.

Adulterated Sweet Spirits of Nitre.—At the Leeds Town Hall, W. Greenwood, of Commercial Road, Kirkstall, was summoned by the Corporation for selling adulterated sweet spirits of nitre. It appeared that Inspector Handford went to the defendant's shop and asked for 6 ozs. of sweet spirits of nitre, for which he paid 1s. 6d., and he told the defendant he purchased it for the purpose of having it analysed by the Public Analyst. The Public Analyst (Mr. Fairley) stated that the medicinal value of the liquid depended chiefly on the quantity of nitrous ether it contained, and that the sample submitted to him contained scarcely any of that element. The defendant said he bought the spirit of nitre, as it was, from two chemists in the town. He was fined 20s. and costs.

Refusing to Sell in the Street.—At Lambeth Police Court, a milkvendor, resident at Peckham, was summoned for refusing to serve Inspector Stevenson, a properly authorised officer. The defence was, that inasmuch as the defendant was hawking milk in the street, he could not be indicted, the Act of 1875 applying only to things "exposed for sale in a shop, premises, or stores." The objection was held be fatal, but a case for a higher court was granted.

Adulterating Beer with Salt.—At the Worcester Police Court, Geo. Y. Houghton, landlord of the "Market Fountain Inn," was charged with having, on June 18th, sold ale adulterated with salt. Mr. Blakeway (of the Town Clerk's office) appeared to prosecute; Mr. Tree defended. Mr. Higgs, inspector, said that he asked the defendant for two quarts of home-brewed fresh ale. The ale was bottled and sealed. Dr. Swete had certified that it contained 98 grains of salt per gallon. On the previous day witness obtained a sample of water from the defendant's well. In cross-examination witness said that he had known the defendant for many years, and had known nothing against him or the beer he sold. Mr. Tree said that there was no evidence that anybody had found fault with the defendant's beer. He reminded the Bench that a grain of salt was the 480th part of an ounce; and as there were sixteen half-pints in a gallon, the quantity of salt which the defendant was charged with having in the beer analysed, 98 grains per gallon, was very small in an ordinary glass of ale. [Mr. Tree produced an envelope, showing the quantity of salt which there would be in half a pint of ale, at the rate of 98 grains per gallon]. Such a small quantity of salt could not be injurious to anybody. Instructions were issued by the Excise authorities, stating what articles were not to be put in beer, and not a word was said about salt. Salt in small quantities preserved beer. A certificate by Dr. Swete was put in, stating that beer brewed from the water which had been pumped from the defendant's well would not contain more than 25 grains of salt. Dr. Swete was examined, and said that he had analysed the water from the defendant's well, and found that it contained 10½ grains of salt per gallon. In cross-examination, Dr. Swete said that from 70 to 75 grains per gallon had been put into the beer. The beer was not home-brewed fresh beer. Any beer containing more than 70 grains per gallon had a salt taste. The natural taste of beer was not salt. In re-examination Dr. Swete said that he did not think salt was usually put into beer. He believed that the large brewers said that they did not put any salt into ale. If he were to drink half-a-pint of beer containing salt at the rate of 98 grains per gallon he should be thirsty and should want another glass. Unfortunately the Excise authorities allowed substitutes for malt and hops. The defendant was then called, and said that he had been eight years at the "Market Fountain." Since Mr. Higgs called, he had brewed ale with other water than that of his well, and his customers told him the ale was not so palatable. He had been in the habit of putting a farthing's worth of salt in 115 gallons of ale. The person who instructed him in the art of brewing told him to put in this quantity of salt. He put it in to make the beer keep and to make it palatable. Mr. Tree said that in the future the defendant would not put any salt into his beer. Defendant was fined 10s. and 50s. costs.

Prosecution by the Metropolitan Dairymen's Society.—Thomas Rose, of Beach Farm, Binfield, Berks, was summoned by the Metropolitan Dairymen's Society for selling to Mr. Barham, of the Express County Milk Company, a churn of milk adulterated to the extent of 15 per cent. of added water. Mr. Ricketts prosecuted, and Mr. Lickford appeared for the defendant. This case had been adjourned from the 28th of July, in consequence of the defendant having raised sundry objections to the form of the certificate, and also questioned the accuracy of the analysis. It appeared that Mr. Barham contracted with the defendant for a supply of pure milk to be delivered at Waterloo Terminus, but as it was found to be adulterated, complaints were made to the defendant, and on the 21st of June a churn of milk was watched from the defendant's farm to the Waterloo Station, where Mr. Parish, the Inspector of the Metropolitan Dairymen's Society, took samples, one of which he detained, one he took to Dr. Muter, and the third was handed to defendant. Dr. Muter's certificate showed that it was *adulterated with 15 per cent.* of added water. The defendant disputed Dr. Muter's certificate, and a sample was sent, at the request of Mr. Ricketts, to Somerset House, to be analysed by the Government Analyst, and his certificate, dated a fortnight afterwards, set forth that the milk was adulterated to the extent of *not less than* 10 per cent. Dr. Muter, who was in attendance, said that the analysis coincided with his own, as the milk at the time would have turned sour, which caused it to be much lower, and an allowance had to be made for this decomposition which was not always certain. The actual figures were practically the same as his own. He had analysed the defendant's milk several times, and found it to be adulterated. The defendant was called, and he denied adding any water or anything else to the milk. He took a sample to the Public Analyst at Reading, and produced his certificate showing that it was pure milk. In cross-examination by Mr. Ricketts, he said he was fined at this Court in February, 1878, for sending up milk adulterated with water. After a lengthy examination and cross-examination of the inspector on sundry technical points, Mr. Slade said that it was his intention to decide in favour of the complainant. If the defendant wished to appeal on those points raised by his solicitor he could do so; and as the sample was not very heavily adulterated he should fine him £5 and £2 12s. 6d. costs.

"Butterine."—At Kensington Petty Sessions, William Nash, dairyman and butterman, 46, Golborne Road, Notting Hill, was summoned by the Kensington Vestry for selling adulterated butter. Thomas Gayland, the inspector under the Food Adulteration Acts, sent a lad into defendant's shop for half-a-pound of 1s. butter, which on being analysed, was found to contain 70 per cent. of foreign fat. Defendant said he bought it as "butterine" or "bosh," and sold it at 1s. a pound without putting any name to it either as butter or anything else. The Bench fined him £2.

"Butterine."—Before the Hyde Magistrates, John Miller, grocer, of Hyde, was charged by Superintendent Cooper with having sold to the prejudice of the purchaser one pound of butter, which was not of the nature, quality, and substance of the article demanded. The case for the prosecution was that, on the 8th of July, two constables saw in defendant's shop window a quantity of what was apparently butter, bearing a label "Millers, butter importers, 7d." They entered the shop and asked to be supplied with "a pound of that butter marked 7d." which was given to them. They told the shopman that it was purchased for the purpose of analysis. On being submitted to the County Analyst, Mr. Carter Bell, of Manchester, it was certified to be adulterated with 36 per cent. of foreign fat. The case for the defence was that the article was not sold as butter, but as "butterine," and that the officers on entering the shop asked to be supplied not with a pound of butter, but with a pound of "that" (pointing to the article which was ticketed 7d.), and that therefore the sale was perfectly legal. The case turned upon whether the article was sold as butter or butterine; the Bench took the former view, and imposed a fine of £5 and costs. Notice of appeal was given.

Butter and "Butterine."—At the Salford Police Court, before Mr. J. Makinson, Wm. Rawlinson, grocer, 316, Regent Road, was summoned for selling "butterine" for butter. The Town Clerk (Mr. C. Moorhouse) prosecuted, and Mr. Edge, barrister, appeared for the defendant. Mr. C. E. Thompson, inspector under the Sale of Food and Drugs Act, said that on the 11th July he went to the defendant's shop and asked for 1 lb. of butter, for which he paid 10d. He told the defendant he had purchased the butter for the purpose of having it analysed. The defendant replied, "Well I bought it as butter, and I expect it is butter." Witness handed over to the Public Analyst a sample of the butter. Mr. J. Carter Bell, Public Analyst, said he had analysed the "butter" purchased at the defendant's shop, and found it contained 85 per cent. of foreign fat. It was what was known as "butterine." Cross-examined by Mr. Edge, witness said he should prefer butter to butterine as an article of food. He concurred generally in the opinion of the Manchester City Analyst (Mr. Estcourt) that the introduction of butterine was a boon to the working classes, and that it was preferable to a good deal of the salt butter sold. Mr. Edge said the defendant's shopman in labelling the butter had made a mistake, and marked it 10d. instead of 8d. per lb. The defendant really believed that he was selling Irish butter to the inspector, and therefore he (Mr. Edge) contended that defendant was not liable to a penalty. The section of the Act under which the defendant was summoned, stated that a penalty might be inflicted where a person sold to the prejudice of the purchaser something which was not of the nature and quality of the article demanded. To bring the present case within the meaning of the statute there must be an intention to defraud by the defendant. There was no such intention, as the evidence of the inspector proved, on the part of Mr. Rawlinson, as there was a *bona fide* belief in his mind that it was butter which the inspector had purchased. The Town Clerk said it was unnecessary to prove any fraudulent intention; the question was whether the defendant sold an article of the nature and quality of the article demanded. If the defendant had been defrauded by his merchant in having palmed upon him butterine for butter, there was a saving clause in the Act which provided for that. The section said that if a person purchased goods, and got a written warranty as to the quality of the goods, the person who sold the articles in the first instance and gave the warranty was liable, if they were found not to be what they were represented to be. A person going into a shop was entitled to get what he asked for, and that was not the case in the present instance; the inspector asked for butter and got butterine. Mr. Makinson held that the case had been clearly proved, and that there need not be any fraudulent intention on the part of the seller to render him liable to a conviction. As to the way in which butterine should be sold he thought it should either be plainly labelled, or that the purchaser should be given to understand that butterine and not butter was being sold. In this case he thought a small penalty would meet the ends of justice, and fined the defendant 2s. 6d. and costs.

Chicory and Coffee.—At the South Staffordshire Stipendiary's Court, before Mr. W. F. F. Boughey (stipendiary magistrate), Mr. Thomas Bird, grocer, Spon Lane, was summoned by Mr. J. G. Horder, the inspector under the Sale of Food and Drugs Act for the district of South Staffordshire, for selling adulterated coffee. Mr. Horder's assistant proved to visiting the defendant's shop and asking for a quantity of pure coffee. Having been supplied, the defendant was informed that the coffee had been purchased for the purpose of being analysed, and that a portion of it would be forwarded to the County Analyst. A certificate had been received from Mr. Jones, the County Analyst, stating that the coffee contained 70 per cent. of chicory. The Stipendiary fined the defendant 2s. 6d. and costs.

Alum in Buns.—At the Cambridge Petty Sessions last month an adjourned case was heard, in which Mr. T. F. Peacock, baker and confectioner, of King Street, was charged with selling buns mixed with alum, so as to render the said articles of food injurious to health. The Town Clerk prosecuted; Mr. J. W. Cooper appeared for the defendant, and also to watch the case on behalf of Messrs. Smith and Sons, of Norwich, the makers of the "Norfolk Baking Powder." Inspector Phillips said: I went to the defendant's shop and got a packet of baking powder from among a large quantity in a box. I marked it with a cross, and gave it to Mr. Knights to be analysed. I then went to Messrs. Gladwyn & Yockney's, and purchased three packets of the same powder. I put a seal upon each. I gave one to Mr. Knights, one to Mr. Bitton, who supplied me with them. Mr. J. W. Knights, Public Analyst, said: I received from Inspector Phillips a sample of the baking powder, and I analysed it. The following is the result of the analysis:—There was of ground rice 43·0, of burnt alum 15·20, of bitartrate of potash and bicarbonate of soda 41·80. By Mr. Adams: I did not examine for the same parts in the buns that I found in the powder. If three-quarters of a packet had been used for making 4 lbs. of buns it would account for the quantity of alum I found in the buns. By the Mayor: If that quantity was used it would make the buns injurious to health. By Mr. Cooper: If a teaspoonful of powder was put to a pound of flour, in my opinion it would render it injurious to health. I know Mr. Sutton, Public Analyst for the County of Norfolk. If he states that this powder, mixed with bread according to directions (one teaspoonful to a pound), is not injurious to health, he is wrong. I know there is potash among the constituents of this powder in sufficient quantity for me to distinguish it. The Mayor said the question was whether the defendant committed the offence with a guilty intention. Mr. Cooper said that was the first question, and the second was, Was the alum injurious to health? The defendant might possibly have put more powder in than the directions allowed. By Mr. Adams: Four teaspoonfuls of this powder would weigh a little over half-an-ounce. Mr. Cooper submitted that under the 5th Section the defendant was not liable unless he knew that the admixture of that powder would produce the effect, and make it injurious to health. The defendant did not know that the article he put in was injurious to health, and he might have put more in than the directions allowed. He proposed to bring before them the Public Analyst for the County of Norfolk, who would show them that one part of Mr. Knights' analysis of that was without doubt a mistake. The Town Clerk said Mr. Cooper would have an opportunity of going into the question, for they would summon the people for selling the baking powder. Mr. Cooper said he would not go into that case then. The defendant was not liable unless they could show that he had knowledge that the powder was injurious to health. Supposing he did it wilfully, he submitted that he (defendant) did not know the baking powder contained an ingredient that would render it injurious to health. The Mayor: You cannot get over the broad fact that there was alum in the buns. Mr. Cooper said they did not dispute that. The question was whether the defendant knew the powder was injurious to health; if he did not know, they would have to acquit him. Mr. Hurrell said his opinion was that the defendant had done something innocently; but he was innocent of the offence. The defendant said the reason why he used more baking-powder than the directions said was because the buns required more. Mr. Hurrell pointed out to Mr. Cooper that at the end of Section 5 it read "Could he with reasonable diligence have obtained that knowledge." He held he (the defendant) could. The defendant was then sworn, and said: I am a baker, living in King

Street. I have been in the habit of using this Norfolk baking powder ever since I have been there. I use it for buns and nothing else. The flour I used was the seconds flour. I put nothing but baking powder in it. I purchased it of Mr. Bitton from Gladwyn and Yockney's. The quantity of the different ingredients I used to make these buns was 4¼-lbs. of flour, a little over a quart of milk, 1½-lbs. of currants, ¾-lb. of sugar, and ¾-lb. of butter and lard together. We put the baking powder into the flour when it is dry, before the dough is made. I had no means of knowing that the baking powder was injurious to health. By Mr. Hurrell: If I had known it contained alum, I should not have used it. Witness continued: There are some papers which say the powder is certified by analysis to be perfectly pure and wholesome, assisting digestion, and that is why I used it. I used this because it requires more in the buns than in the dough to get them light. By the Town Clerk: I read the directions—one teaspoonful to a pound of flour; but that did not make it light, so I used more. The Defendant: I know I am perfectly innocent. Mr. Hurrell: I have no doubt of it. By the Mayor: Assuming I used yeast instead of baking powder, I should use more to buns than to bread. Mr. Cooper said there were some papers which the defendant had with the powder, and which said it was certified by analysis to be perfectly pure and wholesome, assisting digestion; therefore, the defendant thought he need not make more inquiries. He submitted that he came withing the 5th Section, and the case would have to be dismissed The Mayor, after consulting with the rest of the Bench, and the magistrates were of opinion that the defendant did not use reasonable diligence, and, considering all the circumstances of the case, they fined him 1s. and expenses. Mr. Hurrell said he thought the defendant's character did not suffer in the slightest possible degree.

NOTES OF THE MONTH.

We must, of course, express our satisfaction at the passing of the Act amending the Sale of Food and Drugs Act. It might, no doubt, have been more useful, had it fixed a standard for drugs and milk, as well as spirits; but, such as it is, we accept it as another effort in the direction of improving the quality of our food and drink. The clause by which inspectors are now enabled to obtain samples from street hawkers, costermongers, and stall keepers, will be extremely useful, as it will bring within the provisions of the Act a class of people who have hitherto eluded them, although dealing in the adulterated articles, for selling which shopkeepers have been convicted and fined. We trust the local authorities will accordingly instruct their officers as to the existence of this new provision.

Milk dealers, too, in their turn, are given the power to have the milk supplied to them examined, and will thus be deprived of the defence so often raised, that they sold the milk in the same state as they received it from the farmer. If they now suspect the milk they are being supplied with to have been watered or tampered with before they receive it, they can get the medical officer of health, or inspector to take a sample at the time the milk is delivered, and, if it has been adulterated, the local authorities can prosecute the farmer in the same way as they do now ordinary tradespeople.

The last clause of the Act, which enacts that summonses must be served within 28 days from the date of purchase of perishable articles, such as butter and milk, deserves particular attention from analysts. When local authorities meet periodically, and cases are reported to them before proceedings are taken, the enactment will sometimes be inconvenient, as the samples may not reach the analyst in time for him to report thereon at the next meeting of the authorities, and the following meeting two or three weeks afterwards may be after the expiration of the 28 days. This difficulty must probably be avoided, by instructions being issued to the officers to apply for summonses, if necessary, immediately on receipt of the analyses.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1878. No.	Name of Patentee.	Title of Patent.	Price.
4544	C. A. Fawsitt	Obtaining Ammonia	4d.
4949	C. W. Siemens	Electric Lamps	6d.
4982	E. J. Atkinson	Calcining Gypsum, Lime, &c.	6d.
5139	W. B. Brain	Electric Lighting	6d.
5281	A. M. Thompson and H. D. Earl	Electric Lamps	2d.
5291	F. Versman and J. von Quaglio	Purifying Coal Gas	4d.
5306	T. A. Edison	Developing Magnetism and Electric Currents, and Apparatus for Illuminating by Electricity	6d.
5307	J. B. Freeman	Carbons for Electric Lighting	2d.
1879.			
33	R. V. Tuson	Disinfectants	2d.
49	J. C. Mewburn	Manufacture of Phosphorous	6d.
65	A. M. Clark	Electric Lamps	4d.
83	W. Ladd	Ditto	6d.
152	J. Imray	Carburetting Gas or Air	2d.
173	S. & M. Baerlein	Manufacture of Sulphate of Alumina	4d.
178	A. de Meritens	Obtaining Light by Electricty	2d.
179	W. R. Lake	Enriching Phosphates of Lime	6d.
277	S. Cohné	Electric Lighting	4d.
325	E. L. Paraire	Electrical Light Apparatus	2d.

Mr. Frederick Hodges, F.I.C., Belfast, has been elected Public Analyst for the County of Armagh.

Dr. Cameron, Dublin, has been elected Public Analyst for the County of Monaghan.

Bread Adulteration in the Eighteenth Century.—In a number of the *Newcastle Courant*, in the year 1759, we read:—" In order to prevent the injurious practice of bakers from adulterating their bread, by noxious and unwholesome mixtures, it was enacted in the 31st year of his present Majesty that persons convicted of adulterating their bread, or having in their possession any mixture or ingredients with an intention to adulterate the purity of meal, flour, or bread, shall forfeit a sum not exceeding £10, nor less than £2, and by the same statute it is directed that the magistrate before whom any such conviction shall be had, may cause the offender's name and place of abode to be published in some newspapers, which shall be printed or published in or near the country, city, or place where the offence shall be committed. Last Wednesday, Thomas Smithers, baker, East Smithfield, was convicted before John Fielding, Esq., in a penalty of £5, for having in his possession a quantity of alum undissolved, and a quantity of alum dissolved, with an intention to mix and adulterate the purity of meal, flour, or bread. * * * * If this inquiry be conducted with spirit upon the present plan of discovery, it is to be hoped that it will be the means of saving the lives of numberless poor infants, whose parents are not in a condition to make their children's pap of anything else but common bread."—*Miller.*

We regret to announce the death, at an early age, of Mr. James Whitla, Public Analyst for the County of Monaghan, and a Member of the Society of Public Analysts.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; Notes on Lubricants, by W. MacIvor.

THE ANALYST.

OCTOBER, 1879.

SOCIETY OF PUBLIC ANALYSTS.

The next Meeting of this Society will be held on Wednesday, the 19th November, at Burlington House.

IODIC ACID TEST FOR MORPHIA.

By J. Carter Bell, F.C.S.

In this note I wish to call the attention of chemists to this most unsatisfactory test. In the chief analytical works iodic acid is quoted as an important test for morphia.

Professor Taylor, in his *Medical Jurisprudence*, says:—" A solution of iodic acid should be mixed with its volume of sulphide of carbon, there should be no change of colour; on adding a small quantity of these mixed liquids to morphia, or its salts, either solid or in solution, the iodine is separated from the iodic acid and dissolved by the sulphide, which sinks to the bottom, acquiring a pink or red colour, varying in its intensity according to the quantity of morphia present. This reaction distinguishes morphia from the other alkaloids which do not decompose iodic acid."

Professor Taylor seems to lay stress upon this test, because at the end of his chapter on morphia, he mentions it again.

In *Watts' Dictionary* the test is also mentioned.

Blyth in his *Manual* says:—" One of the best confirmatory tests is the action of iodic acid." He even goes farther, and gives a special note upon this test, but no precautions.

In *Fresenius' Qualitative*, eighth edition, the test is mentioned, but with precautions as to its use, thus:—" As other nitrogenous bodies (albumen, caseine, fibrine) likewise reduce iodic acid, this reaction has only a relative value; *however*, if *ammonia* is added after the iodic acid, the fluid becomes colourless, if the separation of iodide has been caused by other substances, whilst the coloration becomes much more intense if it is owing to the presence of morphia."

The foregoing statements do not accord with my experience: for I find that other substances, such as ipecacuanha, guaiacum, will produce the pink colour; and, also, that *ammonia is not* able to distinguish between the pink colour of morphia and that produced by other substances.

This statement may be easily verified by putting into a test tube 2 c.c. of a solution of iodic acid (one part of the acid to 15 of water), and 2 c.c. of bisulphide of carbon; to this mixture is added a milligramme of hydrochlorate of morphine, and, on shaking, the beautiful pink colour is communicated to the bisulphide of carbon; on adding 5 drops of ammonia, the colour disappears. A few drops of ipecacuanha wine, in the place of the morphia, will produce the same result. Such a doubtful test ought to be banished from all toxicological works; or, if mentioned, should be qualified by this statement—that if no pink colour is produced, the absence of morphia may be presumed.

ON THE RELATION BETWEEN DR. KOETTSTORFER'S PROCESS OF BUTTER ASSAY, AND THE OLD PROCESSES.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, at Sheffield, on 22nd August, 1879.

Dr. Koettstorfer's process appeared to me likely to prove very valuable in the ordinary analyses of butter, by at least disposing without further labour of most of the genuine samples; but it was obviously impossible to adopt a new process as a basis of an adverse report, until it had been thoroughly tested. It appeared to me, that the most practical mode of testing it was to submit to this process (in addition to the tests which would otherwise have been made) every sample of butter or other fat which was received. I therefore adopted it as an auxiliary process, and have examined nearly 100 samples by it.

As a general opinion, I may state that I am well pleased with the process for the purpose above mentioned. It is not, however, free from its weak points.

Carbonic acid acts very much on the colour of phenol-phthalein, and, in order to ensure fair accuracy, it is essential that the fat should be saponified with the alcoholic potash solution in a flask, which certainly ought to be corked with a cork having a notch in the side. While the alcohol itself is boiling pretty freely there is, of course, no risk of carbonation, but, as soon as the water is added to dilute the soap for titration, the risk increases greatly.

My experience also indicates the necessity for the use of a very large excess of potash solution, an excess very much larger than would be ordinarily employed when the fatty acids were to be weighed. It appears desirable to use at least twice as much potash as would be actually required to combine with the soap present.

Again, in reference to the potash solution itself. I find that a very small amount of colour seriously masks the end of the titration, and it becomes essential to use pure potash, and to keep the solution in hard glass bottles, so as to prevent the additional colour which is often imparted by the decomposition of the glass of common Winchesters.

Taking all these precautions, however, I find the process a useful one. But I must call special attention to the following exceptions:—It is comparatively useless when applied to old samples of butter, which have been alternately heated, and cooled; and, even in the cases of lard and butterine, repeated heating exercises a more uncertain effect than it does on the fatty acid determination; but, although useful, it can never come into general use as a substitute for the determinations of fatty acids and soluble acids, because any alkalies added to the fat, whether fraudulently, or for supposed preservative purposes, entirely upset the estimation. Therefore, while it may be—and in my opinion is, when properly carried out—a safe process on which to pass a butter as genuine, it is quite unreliable as a proof that the butter is adulterated. The admixture of three per cent. of carbonate of soda with the salt added to the butter, will, by this process, change the results so much, that a genuine butter would be condemned; and such a percentage of admixture is one that has been used, while smaller percentages are common.

By the fatty acids' process, such an admixture would have scarcely any sensible effect, but it would exercise a very important effect on the actual density of the fat, and, indeed, in certain cases, might render the determination of actual density quite fallacious. Unfortunately merely testing the water present in the sample of butter for alkalinity is not sufficient to prove whether alkaline carbonates have been added, and no test seems readily available. I have, therefore, come to the conclusion that it is unsafe and unjust to condemn any sample of butter as adulterated on either the titration or specific gravity processes. If the sample passes these tests well it may be relied on as genuine, but it may fail to answer both tests, and yet have no foreign fat mixed with it. In such a case, a full determination of both soluble and insoluble fatty acids, is the only safe course to adopt.

Of course, therefore, I view the relation between the actual density, fatty acids and titration results as a matter of no great importance in adulterated samples, but in genuine samples it is otherwise.

Dr. Koettstorfer found that the amount of KHO required by genuine butters ranged from 23·24 to 22·15 per cent. It is, of course, with the lowest limits only that we have to concern ourselves, and my opinion is, that this limit is not low enough even in the case of fresh samples, and that it is very seriously deficient in the case of samples which have been kept and subjected to even moderate variations of temperature.

I have had several samples of butter apparently recently made, and, certainly, in good condition, which have required as little as 21·34, 21·36, 21·50 per cent. of KHO to saponify them, and which have yet given less than 89 per cent. of fatty acids by the flask washing process, and which, independently of the other conditions, I certainly would not condemn as adulterated. In my opinion, therefore, the titration process can only be relied on when it shows figures higher than Koettstorfer has put as the limits. As, however, three samples out of every four received are probably genuine, the process may be advantageously used for passing these pure samples, provided proper care is taken to carry the analysis further if these results are adverse, and it is for this purpose only that the process can come into general use.

I think that any sample of butter fat, which requires more than 22·60 per cent. KHO for saponification, as determined by the titration process, may safely be passed as genuine; but that any lower result should be checked by a full analysis.

ON THE RATIO OF EXPANSION BY HEAT OF BUTTER FAT, LARD FAT, AND BUTTER SUBSTITUTES.

By G. W. Wigner, F.C.S.

I have made some accurate determinations of the ratio of expansion of fats, especially butter fat and the fats used for adulterating butter. These determinations will be of service, since, by their use, the specific gravity of melted fats may be taken at temperatures varying within reasonable limits from the 100° F. usually adopted, and the results so obtained may be directly compared with the specific gravity at 100°. They will, also, have the advantage of rendering the use of the specific gravity bubbles, which I proposed some years ago[*] for this purpose, more convenient.

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[*] See Analyst, vol. i., p. 115.

I have tested the ratio of expansion of butter fat for every 5° between 100° Fahr. and 212°. The determinations have been made independently by three different processes.

1st. By direct weighing of the melted fat in a specific gravity bottle, with thermometer stopper. At the higher temperatures this method is certainly open to greater errors than are desirable, on account of the low conductivity of the melted fat for heat, which renders it a long task to secure an absolute temperature throughout the bottle.

2nd. By means of thermometer tubes with large bulbs. This process would, probably, give the most accurate results, if it were not for the tendency of the different fats to crystallize, and, apparently, to some extent to separate when enclosed in the bulb, without the possibility of agitating them.

3rd. By means of specific gravity bubbles of various weights. This latter process gives results slightly inferior in accuracy to the other processes, when they are carried out in the most careful way; but it is yet so simple and certain in its results, that it is impossible, with ordinary care, to incur any error which is of importance, when the process is used for analytical purposes.

I have not corrected the figures for the cubical expansion of glass, because the results are primarily intended for the use of analysts who will weigh the fats, or measure them in glass vessels, as I have done.

1st. Expansion of Pure Butter Fat.—100 volumes of pure butter fat, at 100° F expand to 1047·2 volumes, at 212° F. This result is the average of seven closel agreeing determinations, on four different samples of butter. This gives an average expansion of ·0434 per degree F., or ·0780 per degree Centigrade.

The ratio of expansion is not absolutely uniform throughout, but differs between 150° and 190° F. From 100° F. to 150° F. it is sensibly in accordance with the average; from 150° F. to 190° F. it increases slightly; and from 190° F. to 210° F. it appears to expand at its former rate of ·0434°. This change in the ratio of expansion is more clearly shown by the lithographed diagram which accompanies this paper.

At first I was inclined to attribute this change to a partial decomposition of some of the constituents of the fat, but, on examining a sample of lard in the same way, I found that an almost identical change took place, and at nearly the same temperatures. Since lard has already been melted at much higher temperatures, and is practically free from the soluble and volatile fatty acids, this explanation seems doubtful.

An artificial butter—"butterine," also showed a similar abnormal rate of expansion, but I cannot speak so exactly as to the temperatures at which the ratio changed.

2nd. Expansion of Lard and Butterine.—The average expansion of lard and butterine (animal) are almost identical. The average ratio for lard, as deduced from the experiments, is ·0420 per degree F. The difference from the butter ratio is so small that it is of no importance for analytical purposes, except for wide ranges of temperature.

It will be more convenient for the use of these figures in the detection of adulteration, to reduce these results to the ordinary figures of actual density, as compared with water at 100°. Actual density, strictly speaking, is weight, as compared with the weight of the same bulk of water at the same temperature, and it was in this *sense* that Muter first used the term in butter analysis, but it is not convenient to

G. W. WIGNER,

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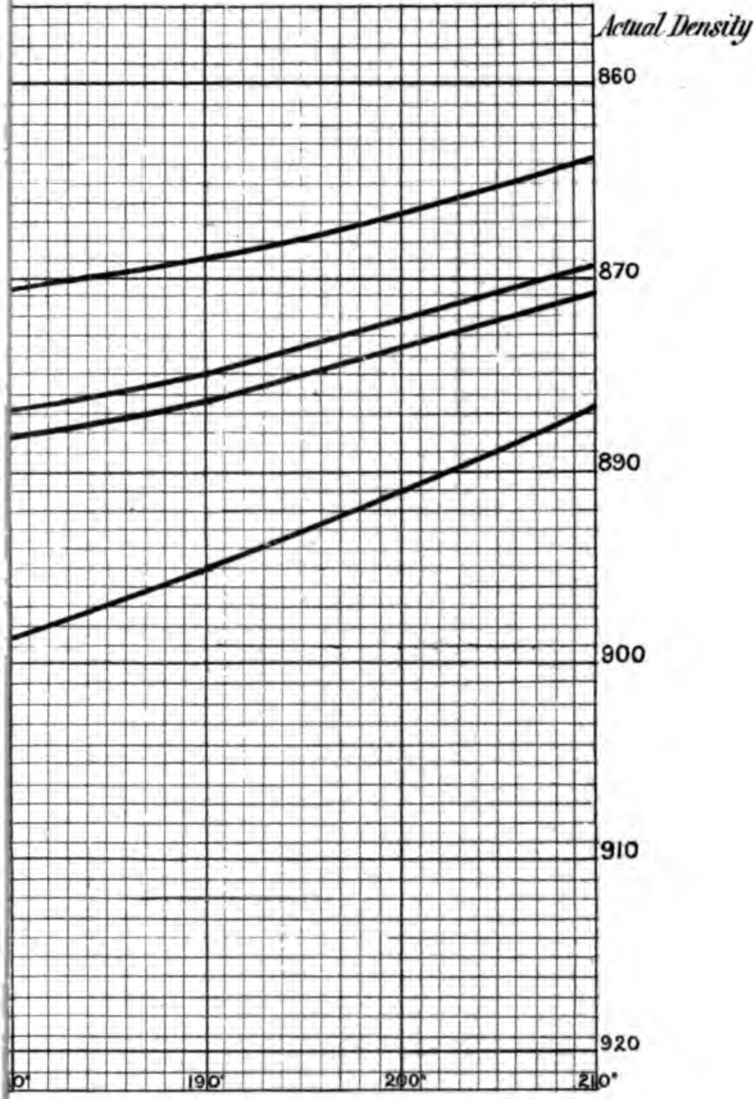

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follow this rule at temperatures above 100°, because whereas water expands more rapidly with increase of temperature, fats do not do so. I therefore compare all the figures obtained with water at 100° as the standard.

Assuming the limit of 911 as the lowest average actual density of a genuine butter at 100° F., we obtain the following rule:

If the temperature exceed 100° F., add to the actual density found by weighing ·377 per 1° F. of excess temperature over the 100°.

It is obvious that the correction to be applied to fats, of slightly lower specific gravity, will scarcely differ from this. In practice it will generally be found that more accurate results can be obtained, by allowing for the error of temperature by this calculation, than by endeavouring to secure an absolute temperature of 100° F.

The diagram of the expansion of the fat will, however, be of assistance in enabling the specific gravity bubbles to be used for the purpose of taking the actual densities of fats. These bubbles expand under the influence of heat, very nearly in the same ratio as the ordinary specific gravity bottles; in other words, notwithstanding the different conditions under which specific gravity bottles and bubbles are made, the cubical expansion corresponds very closely, and, consequently, in this respect no sensible error is incurred by the use of the bubbles, since the results obtained are practically identical with those which would be obtained by weighing in glass bottles. An accurate determination of the specific gravity of a bubble, at a temperature of 60°, will be all that is necessary; or, if preferred, the actual specific gravity of the bubble may be found by testing it on melted fat, the actual density of which has been accurately determined at 100°, and calculating the result obtained from the expansion of the fat.

I need hardly point out that it is useless to rely on any approach to accuracy in the bubbles as sold. I believe this inaccuracy is mainly due to the bubbles being marked before the glass has assumed its permanent form.

If the sample of fat to be tested is gently and slowly heated, until the bubble of known specific gravity begins to fall, and the temperature of the fat noted, a glance at the diagram will show at once the actual density of the fat at 100° F. Every degree F. difference of temperature corresponds to ·377 of actual density, and, as it is perfectly easy to determine the sinking point to ·5 F., the actual density can in this way be ascertained to within ·20, which is as near an approach to accuracy as is requisite in most cases, or even practicable, from a single experimental weighing. Should the specific gravity determinations not coincide with those of a genuine fat, a further analysis is in any case essential.

BRITISH PHARMACEUTICAL CONFERENCE.

The following are abstracts of some of the Papers read at the Meeting at Sheffield in August last:—

NOTES ON PETROLEUM SPIRIT OR "BENZOLINE."

By Alfred H. Allen, F.C.S.

Although it is well known to professional chemists that petroleum spirit is composed of hydrocarbons quite distinct from those constituting coal-tar naphtha, among the general public, and to a certain extent among people possessed of some knowledge of chemistry, great confusion has arisen as to the nature of the liquids known in commerce as "benzine," "benzene," "benzol," and "benzoline." Of these, the hydrocarbon *benzol* or *benzene*, C_6H_6, is the chief and characteristic constituent of coal-tar naphtha, while it is present in very insignificant amount in petroleum spirit or mineral naphtha. The terms *benzine* and *benzoline* have no scientific application, and are merely commercial names for petroleum spirit. It is owing, in a great measure, to the similarity of these names to those of the chief constituent of coal-tar naphtha that confusion has occurred, but it has been made far worse by the accidental or intentional substitution of one liquid for the other, until it is difficult to obtain the coal-tar product retail, even when it is asked for by its proper name. This would be of but little consequence if the two liquids were of exactly similar nature, but in certain cases they present decided differences of behaviour, although in general characters there are very close resemblances.

The following tabular statement of the characteristic differences between petroleum spirit and coal-tar naphtha has been compiled from various sources and includes a few original tests. All the characters given have been carefully verified by actual experiment on representative samples of commercial petroleum spirit and coal-tar benzol.

Petroleum Spirit, "benzoline," or "benzine."	*Coal-Tar Naphtha, or "benzol."*
1. Consists of *heptane*, C_7H_{16}, and its homologues.	1. Consists of *benzene*, C_6H_6, and its homologues.
2. Heptane contains 84·0 per cent. of carbon.	2. Benzene contains 92·3 per cent. of carbon.
3. Burns with a somewhat smoky flame.	3. Burns with a very smoky flame.
4. Commences to boil at 51° to 60° C.	4. Commences to boil at about 80° C.
5. Specific gravity about ·69 to ·72.	5. Specific gravity about ·88.
6. Smells of petroleum.	6. Smells of coal-tar.
7. Dissolves iodine, forming a solution of a raspberry red colour.	7. Dissolves iodine, forming a liquid having the colour of a solution of potassium permanganate.
8. Does not sensibly dissolve pitch, and is scarcely coloured by it, even on prolonged contact.	8. Readily dissolves pitch, forming a deep brown solution.
9. When shaken in the cold with one-third of its volume of fused crystals of absolute carbolic acid, the latter remains undissolved.	9. Miscible with absolute carbolic acid in all proportions.
10. Requires two volumes of absolute alcohol, or four or five volumes of methylated spirit of ·828 specific gravity for complete solution at the ordinary temperature.	10. Miscible with absolute alcohol in all proportions. Forms a homogeneous liquid with an equal measure of methylated spirit of ·828 specific gravity.

Although the foregoing tests are abundantly sufficient for the distinction of petroleum spirit and benzol, when applied to mixtures of the two products they are of but little value even as qualitative indications, and in that case the density is the only one of the above characters which is capable of giving even an approximation to the quantities in which the constituent liquids are mixed.

The action of nitric acid on coal-tar naphtha is well known to result in the formation of nitrobenzene and its homologues, and has been employed by Schorlemmer for detecting traces of benzene, &c., in petroleum. On the other hand, the action of nitric acid on the hydrocarbons of the paraffin series, which constitute practically the whole of petroleum spirit, is almost *nil* in the cold, even if fuming acid be used, and is very limited in extent if hot acid be employed, provided that the very strongest be avoided. I found by experiment that the action of nitric acid on petroleum spirit was, under certain conditions, even more limited than I had supposed, and eventually I found that by employing the acid in a particular manner, it was not only possible but easy to effect a tolerably perfect quantitative separation of coal-tar naphtha and petroleum spirit.

The following was the mode of treatment eventually employed, and, by adhering to it, it is possible to detect and approximately estimate the proportion of petroleum spirit existing in a mixture of it with benzol, in ten or fifteen minutes:

A known measure of the sample (from 4 to 6 c.c.) was treated with four times its measure of yellow nitric acid of 1·45 specific gravity. The mixture was made in a flask, to which a condensing arrangement was attached. Slight heat was applied externally by means of a flame if the spontaneous action was not sufficiently vigorous. After about five minutes the contents of the flask were cooled, and then poured into a narrow graduated tube. Any oily layer was measured and removed with a pipette, and the remaining liquid poured into a large excess of water.

When ordinary petroleum spirit is thus treated the nitric acid becomes coloured more or less brown. Very little heat is evolved, but on applying moderate heat externally the production of red fumes proves the occurrence of a certain amount of action. The effect, however, is not so violent as I had anticipated from a perusal of Schorlemmer's description of the reaction, and, if the experiment be carefully made, the petroleum spirit employed forms a layer on the nitric acid, and on transferring the liquid to a graduated tube is found to occupy the original volume of the sample used. This is true whether petroleum spirit alone be operated on or whether it be previously mixed with various proportions of coal-tar naphtha. If the proportion of the latter be large, the quantity of nitrobenzene formed is larger than can be retained in permanent solution in the nitric acid. This fact causes no inconvenience, for the nitrobenzene forms a separate layer below the petroleum spirit, and in presence of nitric acid is not miscible with it. Nitrobenzene and petroleum spirit are perfectly miscible alone, but on shaking the mixture with strong nitric acid the nitrobenzene is dissolved out. It will be seen, therefore, that the reaction with nitric acid may be conveniently employed for the determination of petroleum spirit in admixture with benzene. Very fair approximate results are obtainable. If the layer of petroleum spirit be removed with a pipette and shaken with water to remove dissolved nitrous fumes, it is obtained in a suitable condition for further examination.

If, after removing the layer of unacted-on petroleum spirit, the nitric acid solution be poured into water, a very sensible turbidity is usually produced, even with petroleum spirit free from coal-tar products, and on filtering off the precipitate, or allowing it to settle, and decanting the liquid, distinct evidence of the formation of nitrobenzene is obtainable by the aniline test. When the more volatile portion of petroleum spirit is thus treated, the nitric acid is scarcely coloured at all, and hardly a trace of milkiness is produced when the acid is poured into water. The brown colour and turbidity on dilution increase with the boiling point of the sample of naphtha, and are strongest with kerosine oil; but in all cases in which petroleum products are treated with nitric acid, the quantity of precipitate on dilution is very insignificant. Although nitrobenzene is recognizable among the products of the action of nitric acid on petroleum spirit, as was shown long since by Schorlemmer, I do not think the turbidity produced on dilution is due solely to its formation. It is probably rather due to the production of various nitro-substitution products, as it is well known that the higher numbers of the paraffin series are far more readily acted on by nitric acid than their lower homologues.

I have attempted to determine the proportion of benzene in a mixture with petroleum spirit, by measuring the nitrobenzene produced, but the results have not been satisfactory, partly in consequence of the solubility of nitrobenzene in water and acid liquids. By employing 250 c.c. of water for dilution, allowing the nitrobenzene to settle completely, decanting the greater part of the water, and pouring the "bottoms" into a graduated tube, the nitrobenzene may be readily measured. If an allowance of 1·5 c.c. be made for solubility in the one-quarter litre of acid liquid, the measure of benzene present in the sample taken may be roughly ascertained by multiplying the number of c.c. of nitrobenzene obtained by the factor 0·85. Thus if V be the volume in c.c. of nitrobenzene, then the benzene in the amount of sample taken was $(V+1{\cdot}5)\times{\cdot}85$. The method is not capable of giving actual results, but may be useful in some cases as a check on the determination of petroleum spirit by measurement of the layer insoluble in nitric acid.

With a view of learning something respecting the proportion of heptane present in ordinary petroleum spirit, I made a mixture in equal measures of four samples of commercial "benzoline," such as is used for sponge lamps. This mixed specimen had a density of ·7001 at 15·5° C., and commenced to boil at about 54° C. It was distilled in the manner first described by Warren, in a flask furnished with an inverted condenser, filled with water, maintained at a temperature of 70° C., a second condenser being kept well cooled by a current of cold water. The distillation ceased when the temperature in the flask was 84° C., that is, 14° C. above that of the first condenser. The water in the first condenser was then raised to the boiling point, and the distillation continued till scarcely any more came over, by which time the contents of the flask were at 114° C. The result of the distillation was as follows—for 100 measures of petroleum spirit taken:—

	Condensed below 70° C.	Condensed between 70° and 100° C.	Condensed above 100° C. (residue).
Percentage by measure	16	56	26
Density at 15.5° C., compared with water at same temperature	·667	·707	·712

The loss was about 2 per cent. of the original measure. Another specimen of petroleum spirit gave 22½ measures of distillate with the receiver at 70° C., 42 per cent. between 70° and 100° C., and 32 per cent. of residue; the loss being 3½ per cent. The densities of the three products were almost identical with those previously obtained.

The observed specific gravities of the first and second distillates correspond approximately with the recorded densities of hexane and heptane, and from this and the known boiling points of these liquids it is evident that the portion of petroleum spirit not condensed at 70° C. will consist chiefly of hexane and lower homologues, while the part condensed at 70° C., but distilling at 100° C., will be chiefly heptane and isoheptane. As, in the experiments described, this fraction measured from 42 to 56 per cent. of the entire spirit, it is evident that the proportion of heptane present equals if it does not exceed that of all the other constituents.*

NOTE ON THE SPECIFIC GRAVITY OF LIQUIDS.

By L. Siebold, F.C.S.

While the great usefulness of the hydrometer for the rapid determination of the specific gravity of all kinds of clear liquids is universally recognized, there appears to be anything but unanimity of opinion as to the value of this instrument as an indicator of the specific gravity of mixtures owing part of their weight to the presence of undissolved or suspended matter. I have therefore made a number of experiments with the object of deciding whether or not the indications of the hydrometer may be depended upon in the case of mixtures containing insoluble powders, oils, resins, &c., uniformly suspended. The results were as follows:—

Mixtures of Precipitated Chalk, Mucilage of Acacia, Syrup and Water—

	Specific gravity by hydrometer.		Specific gravity by balance.
No. 1.	1·106	..	1·1066
,, 2.	1·070	..	1·0710

Mixtures of Magnesia, Mucilage and Water—

	Specific gravity by hydrometer.		Specific gravity by balance.
No. 1.	1·059	..	1·0598
,, 2.	1.036	..	1·0359

Mixture of Precipitated Chalk and Water only—

Specific gravity by hydrometer.		Specific gravity by balance.
1·037	..	1·0396

The difference in this case arose from the fact that it was impossible to read off the specific gravity quickly enough, for in the absence of the mucilage or any other binding substance, the chalk began to subside immediately after shaking, thus causing a continual decrease in the specific gravity.

Mixtures containing subnitrate of bismuth, heavy spar and other mineral powders, each suspended by mucilage, were tested in the same manner and likewise gave concordant results.

Emulsions of Oil of Almonds, Gum Acacia, and Water—

	Specific gravity by hydrometer.		Specific gravity by balance.
No. 1.	1·010	..	1·0110
,, 2.	1·007	..	1·0070

Emulsion of Copaiba, Mucilage and Water—

Specific gravity by hydrometer.		Specific gravity by balance.
1·014	..	1·0144

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* The physical properties of the benzoline examined by me are very different from those attributed to the liquid by Wiederhold, who on fractionally distilling benzoline of ·715 sp. gr., which commenced to boil at 60°, obtained—

48·6 per cent. of ·70 sp. gr., boiling at 100°.
45·7 ,, ·73 ,, ,, 200°.
5·7 ,, ·80 ,, ,, above 200°.

Various samples of Milk—

	Specific gravity by hydrometer.	Specific gravity by balance.
No. 1.	1·030	1·0305
„ 2.	1·028	1·0278
„ 3.	1·032	1·0316
„ 4.	1·029	1·0300

Officinal Mucilage of Acacia—

Specific gravity by hydrometer.	Specific gravity by balance.
1·165	1·1670

The last determination was made in order to see whether the great viscosity of the liquid would have any notable effect on the indications of the hydrometer.

All the determinations were made at 62° F. The set of hydrometers used consisted of instruments specially made for very short ranges of specific gravities, the correctness of which I had frequently checked in previous determinations.

The foregoing experiments prove that carefully made hydrometers afford reliable indications of the specific gravities of liquids, no matter whether their gravity is due to dissolved or suspended substances.

THE APPLICATION OF CHLOROFORM IN THE TESTING OF DRUGS.

By L. Siebold, F.C.S.

In the 'Year-Book of Pharmacy' for 1877 there occurs an abstract of an article by Dr. C. Himly on the Detection of Mineral Adulterants in Flour by means of Chloroform. Having frequently tried this test and finding it extremely useful both as a qualitative and as a quantitative process, it appeared to me desirable to ascertain to what extent it might be advantageously employed in the testing of powdered vegetable drugs. As many of the latter are lighter than chloroform, and the usual mineral adulterants sink in that liquid, it was but reasonable to infer that this mode of separation might prove of value to the pharmacist.

I will not trouble the meeting with the details of my experiments, but confine myself to a brief summary of the results. In each experiment a small quantity of the dry powder was well shaken with about half a test-tubeful of chloroform, and the mixture allowed to stand at rest for twelve hours. The following drugs were found to rise so completely to the surface of the chloroform, that the observation and estimation of any mineral adulterant became a very simple and easy task:—Acacia, tragacanth, starches, myrrh, Barbadoes aloes, jalap, saffron, cinchonas, nux vomica, mustard, white pepper, capsicum, and guarana. Known quantities of selenite and of chalk were added to these drugs, and subsequently determined by running the lower stratum of the chloroform with the sediment into a small dish, carefully pouring off the chloroform, drying the sediment at a gentle heat and weighing it. The result in each case was very satisfactory. No such accuracy could be attained by incineration, as in the presence of chalk there was always a loss of carbonic acid, and in that of selenite a loss of water and of oxygen, the sulphate being partly reduced to sulphide. An estimation of these adulterants by the usual analytical processes would, of course, give exact results, but prove much more tedious.

Both for qualitative and for quantitative purposes, the chloroform test therefore answers extremely well with the drugs named. In the case of the following substances no complete rise to the surface of the chloroform took place, but a portion was found to float and another portion to sink, though the absence of mineral adulterants was proved by analysis:—Gamboge, scammony, opium, Socotrine aloes, liquorice root, ginger, colocynth, cousso, ipecacuanha, cinnamon and cardamoms. Of the last two by far the greater portion was found to sink in chloroform. But even in these cases the test is not altogether without value, for a careful inspection of the sediment will show whether or not it is a mixture of various substances, differing in appearance, weight, &c. The mineral adulterant will generally, in such a case, form the lowest stratum of the sediment. A comparison with a genuine sample helps to arrive at a correct conclusion. Moreover the chemical examination of the sediment gives results which cannot always be obtained by testing the ash. Take the case of cinnamon, for instance, which contains organic calcium salts. These upon incineration leave calcium carbonate, and a qualitative analysis of the ash would therefore fail to show whether this calcium carbonate was solely the result of ignition, or whether a part of it pre-existed in the cinnamon powder as an adulterant; while the addition of hydrochloric acid to the lowest stratum of the chloroform sediment would settle this point at once.

It is, however, in the case of the drugs first named that I wish specially to recommend this mode of testing to pharmacists.

ON THE VALUATION OF CITRATE OF IRON AND QUININE.

By Frederick W. Fletcher, F.C.S.

The author said that observations have hitherto been confined, with scarcely an exception, to the determination of the total alkaloid present in the citrate, without regard to its purity as quinine. He had adapted to this salt the process described by Dr. Paul for testing quinine, in the valuable paper which he communicated to the Pharmaceutical Society at an evening meeting in February, 1877. Dr. Paul had stated that a sample of sulphate of quinine, containing an admixture of no less than 30 per cent. of cinchonidine, might, if examined by the Pharmacopœia test, be passed as pure quinine. The author had found 10, 15, and even 25 per cent. of sulphate of cinchonidine in foreign quinines, which would, however, pass the Pharmacopœia test. Nor will the Pharmacopœia test detect cinchonidine in citrate of iron and quinine. The alkaloid obtained from the citrate in the manner directed in the Pharmacopœia will dissolve in pure ether, even though 25 per cent. of its weight is cinchonidine. The adaptation of Dr. Paul's plan of fractional crystallisation, which the author had devised, is easy of application, and although a considerable quantity of the citrate has to be operated upon, there is little or no loss of quinine, most of the alkaloid being recovered as sulphate. It has, moreover, the advantage of combining three operations in one, as the results indicate:—(1) The exact amount of anhydrous alkaloid; (2) the proportion of the latter which can be converted into crystallisable sulphate of quinine, and (3) the percentage of alkaloids other than quinine.

The operations involved are briefly as follows:—Place 20 grammes of the citrate in 100 c.c. flask, dissolve in 50 c.c. of distilled water, and add gradually an excess of ammonia (·960), shaking well after each addition. This is important, in order that the quinine may separate in a state of fine division, as otherwise it is apt to be thrown out in tough lumps, difficult of subsequent solution. Pour in 25 c.c. of washed ether, and agitate with a rotatory motion till the alkaloid has completely dissolved. Transfer the mixture to a small glass separatory funnel, and having run the lower stratum of liquid back into the flask, pour the ethereal solution into 100 c.c. platinum capsule. Treat the liquid in the flask with 20 c.c. more ether, and proceed as before. Repeat this operation a third time. The capsule containing the mixed ethereal solutions is then placed in a saucer of water, and the ether blown off by a current of air from a Fletcher's bellows. This immersion of the capsule in water obviates the tendency of the ether to creep up the sides. The platinum dish, which will now contain a pasty residue, is next placed in the air-bath, previously heated to 120°, and in 15 minutes desiccation is complete. After cooling in an exsiccator, the capsule is covered and removed to the balance. The weight, minus that of the capsule and cover, multiplied by five, is the percentage of total alkaloid. The author had made many hundreds of analyses by this process, and in cases where a determination had been repeated had never found the results vary more than 0·1 per cent. When an estimation of total alkaloid only is required, 2 grammes of citrate is a sufficient quantity to operate upon.

The anhydrous alkaloid is now to be converted into basic sulphate. According to calculation the weight of anhydrous alkaloid in grammes is multiplied by 30·86, and the number of c.c. of decinormal sulphuric acid thus indicated are run into the platinum capsule from a burette, and the former being placed on wire gauze over the flame of a rose burner, the contents are briskly stirred until the alkaloid is all taken up, and a clear solution obtained. This is then transferred to a flask and allowed to cool spontaneously. The crystalline mass which will have formed is thrown on a small calico filter, about 3 inches square, stretched over a beaker, and, when drained, tightly squeezed to remove the last few drops of liquid. The latter is then filtered into a stoppered graduated tube of about 150 c.c. capacity, and its volume noted. Twenty c.c. washed ether and an excess of ammonia are then introduced, and the whole, after being well agitated, set aside for six hours.

In the meantime the squeezed residue is detached from the calico filter, and dried in the air-bath at a temperature of 100° C. The weight multiplied by 1·18 represents its value as crystallised sulphate of quinine. To this is added the amount of the latter contained in the mother liquor which has been separated (and which may be estimated to contain 1 part in 750), and the total will then represent the proportion of anhydrous alkaloid which can be converted into sulphate.

At the expiration of the time mentioned, the tube which has been set aside is examined, when the cinchonidine and quinidine present will be found to have crystallised out, at the junction of the two liquids. The stratum of ether is removed by a small Nessler pipette; the crystals washed with two successive portions of 10 c.c. of ether, the last few drops of which can be absorbed by a little roll of filter paper. The crystals are then thrown upon a double-tared filter, made, of two papers weighed one against the other, by cutting down the heavier, dried at 120°, and placed on the balance, the outside paper acting as a counterpoise. In practice the author finds that the weight of this first crop of crystals represents on an average two-thirds of the total cinchonidine or quinidine present. If, therefore, the amount does not exceed ·1 gramme, the percentage of these alkaloids may be estimated to be below 5 per cent. Should the first weighing exceed this limit, the sulphate obtained from the first crystallisation must be dissolved in 100 c.c. boiling water, and treated as before, the weight of alkaloid separated by ether being of course added to the amount first obtained.

As thus described, the process may seem tedious, but in reality it is not so. Not counting the time which must be allowed for crystallising, the entire estimation may be completed in something under two hours. The method, of course, does not distinguish between quinidine and cinchonidine, the usual tests for which must be applied to the solution of the mixed sulphates. This, however, is a point of minor importance. Two examples will be sufficient to illustrate the working of the process.

Descriptions of experiments were then given, and the author added in conclusion :—

Whether the presence of 5, 10, or 20 per cent. of cinchonidine would bring a sample of citrate of iron and quinine, which nevertheless answered the B.P. test, within the reach of the Adulteration Act is a point upon which I offer no opinion. An eminent analyst with whom I was lately discussing the point took the negative view. If such is really the case, a revision of the Pharmacopœia will come none too soon. The plausible excuse which is sometimes set up that manufacturers cannot perfectly separate the cinchonidine from the quinine except at a greatly enhanced cost is utterly without foundation. The white sulphate manufactured both by Messrs. Howard and Mr. Whiffen I have never found to give the slightest reaction with Paul's test, and, what is a still more striking fact, the so-called unbleached quinine of the latter maker is frequently quite free from cinchonidine. Certain of the foreign makers are also, as a rule, unimpeachable in this respect, whilst, on the other hand, some others are systematically adulterated.

It may be worth noting, as a matter of practical interest, that the substitution of 1 per cent. of cinchonidine for quinine in the manufacture of citrate of iron and quinine reduces the value ½d. per oz. for each such addition ; and when it is remembered that the Pharmacopœia test will easily pass 20 per cent. of cinchonidine, and that the consumption of the citrate is considerably over 100,000 oz. per annum, the valuation of this preparation becomes a question of commercial as well as of chemical interest.

ANALYST'S REPORT.

The Adulteration of Milk.—Dr. C. Meymott Tidy, the medical officer of health for Islington, in his annual report which he has just issued, states that during the year ending Lady-day, 1879, he examined 172 samples of food, and, except in the milk, he found no such evidence of adulteration as warranted him in advising a prosecution. In 12 of the milk cases he gave certificates of adulteration. They were all cases of added water, the adulteration varying on the lowest possible calculation from 10 to 30 per cent. Dr. Tidy adds :—"The milk-sellers have raised the price of their milk, but I can scarcely say that the quality has been improved, the price being, in fact, no guarantee of genuineness. The extent to which milk is adulterated is serious. For we must remember that to many (and those for the most part the very old and the very young) milk constitutes the sole article of diet. The doctor can easily be thwarted in his treatment of a patient by the dairyman. The public are in this way cheated of their money ; and if that were all it would be bad enough, but they are cheated of their health too. And yet during this year only a single sample of food was submitted to me by the public for examination, and that one article was not milk, but whisky." In concluding his report Dr. Tidy says :—Would it not be worth while, remembering that there are yet so many things to be attended to, and so many reforms needed, in respect chiefly to the drinking habits of the people and their method of life, for sanitarians to turn their attention for a few years to these sadly-neglected topics, instead of confining their thoughts almost exclusively, as they have been doing of late years, to the water as the source of all ills and miseries? It is not simply the time wasted on the subject that is to be deplored, but it is the unnecessary alarm the discussion of such subjects excites in the public mind."

LAW REPORTS.

Camberwell Butter Case.—At the Lambeth Police Court, a charge of selling adulterated butter was investigated. The case had previously been remanded on the application of the defendant, Mr. A. Bullard, cheesemonger, New Church Road, that the sample might be sent to Somerset House for analysis. On the case being proceeded with on the 13th September, the magistrate read the following certificate, which had been received from the Somerset House authorities, signed by Messrs. R. Bannister, G. Lewin, and J. Cameron:—"We hereby certify that we have analysed the butter, and declare the results of our analysis to be as follows:—Water 12·05, curd 1·95, salt 0·96, fat 85 04 in the 100 parts. From a consideration of the results of a full analysis of the fat we are of opinion that the butter is genuine." The magistrate, Mr. Saunders, remarked that there had evidently been a lamentable miscarriage on the part of some of the Camberwell authorities, for a case of this kind was calculated to do much harm to a trader, inasmuch as the fact of his being prosecuted for selling an adulterated article became widely known, and though the fact of its being adulterated was afterwards publicly disclaimed, yet this disclaimer would not reach a tithe of the number who had heard of the charge against the trader. The defendant's solicitor, Mr. Chipperfield, assented to the magistrate's remarks, and stated that samples had on several previous occasions been taken from his client, which had always proved pure, whilst, in addition, a sample of lard, taken at the same time as the butter which was the subject of this case, had been found unadulterated. He should therefore ask that full costs be given. He further remarked that he had sent a sample of this same butter to Mr. Hehner, who had had considerable experience, and Mr. Hehner was then present, and would say that the butter was entirely pure. The Prosecuting Solicitor, Mr. Marsden: I shall ask for an adjournment that I may get the Government analyst here, because the certificate I have is equally strong. Mr. Saunders: This has been referred to Somerset House, the chief authority on the subject, and I can do nothing if you have these analysts here. Mr. Marsden: May I not be allowed to cross-examine the chemist who made this analysis? Mr. Saunders: No, I think not. Mr. Chipperfield: Mr. Hehner would show you, from the Public Analyst's own report alone, that the butter is pure. Mr. Saunders (to prosecuting solicitor): If you cross-examine them I could not do anything. I must take this certificate as conclusive, and that being so, it would be manifestly inconvenient in conducting public business to send a sample to Somerset House for analysis and then bring the analysts here to be cross-examined. You may be quite sure that the Somerset House authorities are the most efficient people, for they have to decide for the whole kingdom, and in most important cases. Mr. Chipperfield: Mr. Hehner reports:—"I have analysed the sample, and find it to contain 87·75 per cent. insoluble fatty acids. From this result it is obvious that the sample was free from foreign fat." And yet Dr. Bernays says that it contains 25 per cent. of foreign fat. Mr. Saunders: I think I ought to allow all reasonable costs, as great inconvenience has been caused to this man. I will say six guineas, I think. When traders act dishonestly I am always willing to punish them, but they ought fairly to be recouped their expenses when it is found that they have acted properly and fairly by the public. Six guineas for costs, and one guinea for the analyst you have brought here, will therefore be allowed.

Heavy Fines for Milk Adulteration.—Robert Pike, a dairyman, of James Street, Exeter, was summoned for having sold adulterated milk. Mr. G. H. Shorto appeared on behalf of the Town Council. The proceedings were taken under the Milk and Drugs Act of 1875. Mr. Shorto said a nominal penalty would not be considered adequate to meet the demands of justice. Mr. Lendon, Sanitary Inspector, said that on Thursday, the 7th September, he purchased three half pints of milk of the defendant's wife. On being tendered the milk witness informed her that he intended to have it analysed, whereupon she said she could not spare it. Witness, however, remarked that "he had got it," and left. Mr. F. P. Perkins, Public Analyst, said he had made an analysis. He found the milk to be diluted with over 25 per cent. of water. Defendant said he kept no cows himself, but bought his milk of Mr. Bricknell, a dairyman. Defendant called his wife, who bore out this statement. The Bench retired for a short time, and, on returning, the Chairman said the case had been carefully considered by the magistrates, who regarded it as a very serious case. Milk was a necessary element in the food of invalids and children, who must be protected from such imposition. Defendant would therefore be fined in the lowest amount in such cases, viz., £5 and expenses (£1 2s. 9d.)—Samuel Bricknell, dairyman, of Holloway Street, was summoned for a similar offence. The evidence of Mr. F. Perkins showed that the milk supplied by the defendant was adulterated with water to the extent of 20 per cent., and a portion of the cream to the extent of 9 per cent. had also been removed. Mr. Fryer appeared for the defendant, and it appeared, in cross-examination, that the defendant was not present when the sample was taken, and that on the morning on which the milk was seized rain had fallen in torrents. Mr. Fryer contended that the case had not been made out, inasmuch as the Act of Parliament had not been complied with. The Act stated that the prosecutors should prove to the satisfaction of the justices that the defendant had had notice of the intended analysis and should accompany him to the analyst. He contended that inasmuch as the complainant gave the defendant no opportunity of accompanying him to the analyst, the Act had not been complied with. He also suggested that the water in the milk might be accounted for by the heavy rains which fell during the time of milking. Mr. Shorto, replying to Mr. Fryer's objection, said the Act to which Mr. Fryer alluded had been repealed in 1875. Mr. George Henry Mugford, boot-maker, of Magdalen Street, and Mr. Mawrice Sewell, grocer, South Street, said they had dealt with the defendant for a number of years, and had never had cause for complaint. The Bench, after a brief consultation, fined the defendant £5 and the expenses. The Chairman said he hoped the present proceedings would be a warning to parties who were vendors of milk not to come before the magistrates.

THE TIME LIMIT FOR SERVING SUMMONSES.—At Clerkenwell Police Court, William Gunning, milk-vendor, of North Street, Pentonville, was summoned at the instance of the Vestry of Clerkenwell, to answer a complaint of having sold milk adulterated with water. Mr. Ricketts, solicitor, attended for the defence. From the evidence of Thain, one of the sanitary inspectors of Clerkenwell, it appeared that on the 30th June he purchased at the defendant's shop a pint of milk, for which he paid twopence. He told the person from whom he purchased the milk that he should take a third portion of it to Dr. Redwood to have it analysed. He did so, and the certified result of the analysis was that there was 30 per cent. of water added to the milk. He understood that defendant kept no cows, but got his milk from wholesale dealers. Mr. Ricketts, for the defence, said, had he gone on with the case, he should have been able to show that the defendant was not much to blame in the matter, but he had an objection to take to the summons which he thought would prove fatal to the proceeding, and would enable the magistrate to dismiss it. The milk was purchased on the 30th June, and these proceedings were not commenced in this Court until the 12th of August; consequently, under the Act to Amend the Sale of Food and Drugs Act, 1875, which received the Royal Assent and came into operation on the 21st of July of the present year, the whole proceeding must be quashed unless the hearing[*] took place within 28 days of the day of purchase. Milk was a perishable article, and this was specially provided for in the amended Act. Mr. Hosack (the magistrate) pointed out that the milk in this case was purchased before the passing of the Amendment Act. Mr. Ricketts said that did not matter. The words of the 10th section of the amended Act were very plain, and were as follows:—"In all prosecutions under the principal Act, and notwithstanding the provisions of section 20 of the same Act, the summons to appear before the magistrate shall be served upon the person charged with violating the provisions of the said Act within a reasonable time, and, in case of a perishable article, not exceeding 28 days from the time of the purchase from such person for test purposes of the food or drug, for the sale of which in contravention to the terms of the principal Act the seller is rendered liable to prosecution, and the particulars of the offence or offences against the said Act, of which the seller is accused, and also the name of the prosecutor, shall be stated on the summons, and the summons shall not be made returnable in a less time than seven days from the day it is served upon the person summoned." That section made it clear that the magistrate could not convict, and therefore he had to ask for the dismissal of the summons. Mr. Hosack, having considered the section, at once dismissed the complaint.—David Edwards, of 230, St. John's Street, Clerkenwell, was likewise summoned for the committal of a like offence. Inspector Cheshire said in this case the milk was adulterated with 27 per cent. of water, but as he purchased the milk prior to the purchase of the milk in the other case, he would, with the permission of the magistrate, withdraw the summons. Mr. Hosack allowed that course to be adopted.—John Campion Kent, of 52, White Lion Street, Pentonville, was summoned for selling milk that was adulterated with 14 per cent. of water, but that summons was also withdrawn.

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[*] This is an error. As will be seen by the section quoted, the *summons must be served* within 28 days, not the hearing take place within that time.—[EDS. ANALYST.]

Adulterated Butter Case.—At Clerkenwell Police Court, Thomas Jones, butterman, of 97, Lever Street, St. Luke's, was summoned by Mr. Edes, sanitary inspector, for having sold butter which was adulterated. Mrs. Robins, of Hull's Terrace, York Road, said that in accordance with instructions she had received from Mr. Edes, she went to the defendant's shop and purchased half-a-pound of butter, at 1s. 2d. per lb. After she had purchased it the sanitary inspector entered the shop and told the defendant he should have the butter analysed by the Public Analyst. The butter was not exposed in the window, and was brought by the defendant from a room behind the shop. The defendant said he had bought the butter from another person, and he did not know it was adulterated. Mr. Edes said the result of the analysis showed that the butter had been adulterated to the extent of 80 per cent. of fatty matter other than butter. The magistrate ordered the defendant to pay a fine of £3.

Heavy Fine.—At the Police Court, Bath, John Croswell, of 5, Bridge Place, Holloway, was summoned for having sold during last month a pint of new milk which was not of the quality and substance demanded. On the 25th ult. Inspector Montague visited defendant's house and asked for a pint of new milk for the purpose of having it analysed. He was supplied by the defendant with a pint of milk, for which the inspector gave him three half-pence. Mr. Gatehouse, Public Analyst, on analysing it, found that it contained 15 per cent. of water. In his defence defendant admitted selling the milk to the inspector, but stated that it was the last that remained of six quarts which he had purchased for another person. The magistrate fined defendant £10 and costs, or 14 day's imprisonment with hard labour. Defendant replied that he could not pay the amount as he had a wife and five children.

At the Marylebone Police Court, Joseph Mason, of 55, Weedington Road, Kentish Town, was summoned for selling a pint of milk, found on analysis to be adulterated with water. Mr. Ricketts prosecuted for the St. Pancras Vestry. It was stated that the defendant was in a small way of business, and that the sample, when analysed by Dr. Thomas Stevenson, the Public Analyst of St. Pancras, was found to be adulterated with added water to the extent of 17 per cent. The magistrate fined the defendant 10s. and 2s. costs.

At Stockton-on-Tees Borough Police Court, Anthony Watson was fined £5 and costs for selling adulterated milk, this being his fourth offence.

NOTES OF THE MONTH.

The great sensation of the month has been the Camberwell butter case, in which the analyst certified to the presence of 25 per cent. of foreign fat, while the chemists at Somerset House held the same article to be genuine. It is with regret that we refer to the matter at all, but, as journalists having the interests of accord among analysts at heart, we feel bound to point out one or two lamentable occurrences in the whole matter. No one for a moment will doubt but that Dr. Bernays gave the analysis his fullest care, and reported according to the best of his judgment, even if, unfortunately, this was faulty. The allegation of carelessness is certainly unfounded. We have been privately favoured with copies of both the reports—that of the analyst, and that of Somerset House. At first Dr. Bernays found the butter to contain :

Water admixed	12·37
" free	3·00
Salt	1·24
Curd	0·20
Fat	83·19
	100·00

The "actual gravity" of the fat was ·911 ; melting point 43·5 ; and the insoluble fatty acids 88·31. Judging apparently by Hehner's original standard, the analyst reported that the butter was presumably mixed with about 25 per cent. of foreign fat, but he did not consider it a sufficiently bad case for prosecution. Here, then, came error the first: for, this report having been submitted to a committee of the Camberwell Vestry, that body decided to prosecute in spite of the analyst's opinion that they ought not to do so, and requested him to give another certificate without the saving clause, which he, unfortunately, did. Now it is evident, that, but for this undue interference of persons totally unskilled in analysis, or the interpretation of analytical results, the subsequent proceedings would not have occurred. We have looked most carefully through the Act, and nowhere do we find any warrant for a committee to sit in judgment on the analyst's certificates. We are aware that it is the general custom, but, it is in our opinion, in the highest degree undesirable. The secret of where the samples were bought, and the results of their examination, are only to be known (as we read the Act) to the inspector, and if he receive a certificate that the article is genuine, he must not take any further step; but if it be a mixture, and the analyst definitely declares it to be so, then he must forthwith proceed to take out a summons. It is, in the interests of traders, that analyses should not be communicated to persons who might themselves be business opponents, and who are therefore unfit to sit in judgment, lest they should use their position, as the analyst's employers, to coerce him to certify against an article when he has doubts of the advisability of doing so. On the other hand, persons may offend and be reported against, and yet, by this secret committee system, the proceedings might for some reason be stopped and the public made to suffer. The sooner, therefore, that vestries entirely give up this system of demanding all the certificates from the inspectors, to overhaul them in committee, the better, as it is not only unwarranted by the Act, but also renders the quarterly report of the analyst a mere farce, of telling men what they already know. The utmost that ought to be required is, that when the inspector receives a distinctly adverse certificate, he should mention the circumstance, and ask for the aid of the legal officers of the vestry as a matter of course. No committee can legally take any cognizance of the number and nature of the samples procured, and the results of their analyses, except upon the quarterly report of the analyst, duly provided for in the Act for their information, and which has to be sent by them, after they have considered it, to the Local Government Board. If Dr. Bernays had seen his way to definitely assert his true position, and refuse to alter anything at the bidding of a body who ought never even to have seen his certificate, he would have done good service, but, even as it is, he has probably done better, because, as it has turned out, the fallacy and illegality of the proceeding has been clearly manifest.

We sincerely wish we could have stopped here, but must now proceed to fault number two. It is evident, from Dr. Bernays using Muter's "actual gravity" process, that he had studied Muter's paper on "butter analysis," in the first number of THE ANALYST. It is a pity that he did not go farther, and adopt the limit therein laid down (which is, as far as we know, that now generally recognised), namely, to calculate the admixture on 87 per cent. insoluble acids (with the proper proportion of soluble acids), but to make no report against any sample under 89 per cent. insoluble with a proportionately low soluble. In that paper, the conclusions of which were subsequently verified by other observers, it was shown that perfectly genuine butter might, when very old and at certain seasons, yield nearly 89 per cent. insoluble acids, and, therefore, although in the Camberwell case some admixture of fat might be probable, it was not certain.

The Somerset House chemists found:

Water	12·05
Curd	1·95
Salt	·96
Fat	85·04
	100·00

We pass over the discrepancies of curd and salt which might always occur, owing to imperfect incorporation, but these gentlemen go on to say:—"From a consideration of the results of a full analysis of the fat, we are of opinion that the butter is genuine." Unfortunately we have not the figures of their full analysis of the fat, and, owing to the official secrecy affected as to their processes and standards, we have no real means of judging; but, supposing they agreed in insoluble acids, &c., with Dr. Bernays, the perfectly safe report to have made, would have been that "it came within the possible limits of genuine butter." It is after all a great pity in the true interests of every one, both analysts, traders, and the public, that Mr. Bell and his colleagues were refused permission to publicly lay their processes and standards before our Society, so that we might fairly discuss and adopt them. It is true, that when individual analysts call at Somerset House, they receive the greatest courtesy, but the only way to avoid repetitions of the Camberwell case is, for the authorities to authorize the chemists at Somerset House to periodically and officially communicate to our Society their ideas as to standards, so that we may discuss them, and substitute perfect accord for occasional discord. Another lesson taught by the case is, that Public Analysts should attend the meetings and join in the discussions of our Society, from which Dr. Bernays was unfortunately compelled, by press of work, to resign some years ago. Had he been with us, and heard all that has been said among us as to butter, he would have adopted the 89 limit long ago, and saved himself much unmerited abuse and annoyance.

Alluding to the statement made by Dr. Bernays before the Camberwell Vestry at the last meeting, the *South London Observer* says that: "The spectacle of several erudite members of the Vestry solemnly checking on their blotting paper the results of the conflicting analyses was sublime, and the value of the whole scientific twaddle indulged in during the discussion was admirably demonstrated by the fact that one learned commentator alluded to Dr. Bernays as the 'analysist,' and another refuted the notion of accepting as infallible that gentleman's 'ipsy dixy!'"

In an article on this case, the *Grocer* gives the advice that traders should cause every analysis to be referred to Somerset House, in the hope, doubtless, that they would occasionally benefit by the lower standards adopted there than by some analysts. This is a proposal we would most cordially endorse, because it would definitely put an end to the abuse showered upon us, as a body, by certain trade organs. It would then be seen by the public, that our decisions would really be reversed in very few cases. Indeed, we are certain that nothing like so great a percentage of our opinions would be altered as is annually done on appeals in the Court of Chancery, and, when such a reversal did occur, no one would think more of it than they do of the reversal, on appeal, of the decision of a Vice-chancellor. That is a thing which happens almost weekly, and yet the judges of the first instance are not abused; so why not accord to us the same amount of consideration? Is it to be held that we ought to be more infallible than a Vice-chancellor?

The *Grocer* argues that the analyses done at Somerset House must be more trustworthy than those by Public Analysts, because the Government chemists have no desire to make "cases." This is, once more, the old, old story! Why on earth should any analyst desire to "make cases?" Neither his appointment, nor his remuneration, in any way depends on such a course. He is not the detective, and he does not even know from whence his samples come, and so what interest can he possibly have except simply to do his duty to the best of his ability? Indeed, if interest acted in any way, it would be in the direction of making as few cases as he could, and so saving the annoyance of attending police courts. That there should be a Court of Appeal in every matter is most desirable, and, no doubt, as science progresses, the differences of opinion will gradually disappear. Why do not the trade journals honestly admit that for one such difference there are plenty of agreements, and, instead of abusing the analysts, direct their pens to persuade tradesmen to act properly up to the Act, and openly label and sell their mixtures as mixtures, so saving both themselves and the analysts a world of trouble. There is, for instance, not a single case of chicory in coffee but might be avoided by a little simple honesty in labelling on the part of the retailer, but if men will sell without declaring they deserve no sympathy. The Act came upon the country at a time when not more than three men professed special attention to food analysis. One of them (the late Dr. Letheby) is dead, and only the other two still survive, and so both Public Analysts and the Somerset House Court of Appeal have had to really learn the special portion of their duties since the passing of the Act, and it is no wonder that things take some time to shake down into order. We venture to say, however, that no country in Europe now contains so many really experienced food experts as Great Britain, and the happy consummation of perfect uniformity would be forwarded if Mr. Bell and his colleagues were not compelled to wrap themselves up in an empirical state of mystery, but were permitted to behave as scientific men should in the nineteenth century, and to communicate their processes and standards to our Society, and so join in advancing the science of food analysis. To be in a position of originating processes and making discoveries, and yet to be debarred from laying their results before their fellow-workers is, indeed, an unenviable position for our *confreres* at Somerset House. Even when officially written to by Dr. Bernays for their limits for butter, so that he might know in future, they were not permitted to put a definite reply on paper, but had to give a vague answer, and offer to show him personally what they must not write. It is surely time that the Board of Inland Revenue saw their way to remove so childish an embargo on the publication of what would, doubtless, be the proofs of the ability of their scientific officers.

Our readers will observe that some milk cases have been dismissed under the new Act, because the summonses were not served within twenty-eight days from the purchase of the samples. This important point should be kept in mind by the inspectors, and the law officers charged with prosecuting under the Act.

What do the censors of the famous self-constituted Institute of Chemistry say to the following? A would-be analyst, who puts F.I.C. after his signature, and whose name appears in the published list as one of the Fellows of the Institute, has been sending letters to food manufacturers something in the following style:—"I have been examining your products and find a large proportion of copper. I shall of course act under proper advice, but I am afraid there is no course open to me but to place the matter in the hands of the proper authorities." In one case the result of the letter was a request to analyse other samples, for which the would-be analyst charged a good round fee, *found copper in each case*, and was unfortunately paid. Similar samples were afterwards submitted to analysts of repute, who found either no copper at all, or the infinitesimal traces which are present in most organic substances. We can scarcely look upon this disinterested (?) work as anything short of a species of black mail. Thank goodness the man is not a Public Analyst. We can give the censors copies of several of the letters which we have seen, and shall be curious to see how these "elevators" of the profession of chemistry will act in the matter.

Mr. John Parry has been appointed Public Analyst for the Borough of Penryn.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879. No.	Name of Patentee.	Title of Patent.	Price.
189	A. H. Allen	Treatment of Sulphurous Gases	4d.
245	R. E. Crompton and J. W. Williams	Apparatus Employed in Electric Lighting	2d.
259	T. W. Grieve	Lamp or Apparatus for Shading Electric Light	6d.
269	F. M. Lyte	Separation of Metals from Metallic Ores by Treatment with Acids, Brine, &c.	8d.
325	E. L. Paraire	Electrical Light Apparatus	2d.
416	J. D. Andrews	Electric Lamps	2d.
427	C. Dubos	Electric Lamps	4d.
461	G. Wheeler	Manufacture of Citrate of Magnesia	6d.
469	N. J. Heckmann	Treatment of Paper and Parchment to detect Erasures	2d.
528	E. T. & W. R. Bousfield	Electric Light	6d.
594	E. G. Brewer	Apparatus for Manufacture of Hydrogen Gas	6d.
673	T. J. Smith	Extracting Mucilage from Seaweed	6d.
698	H. J. Smith	Contrivance used in Processes Involving Formation, &c., of Chemical Compounds	6d.
705	W. J. Strype	Apparatus for Manufacture of Sulphuric Acid	6d.
713	O. C. Ross	Production of Sulphur	4d.
778	J. C. Mewburn	Apparatus for Cooling Fatty Acids	6d.
863	C. D. Abel	Electric Lamps.	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' *Record; New* York Public Health; Philadelphia Printers' Circular.

THE ANALYST.

NOVEMBER, 1879.

SOCIETY OF PUBLIC ANALYSTS.

The next Meeting of this Society will be held at Burlington House, Piccadilly, on Wednesday evening, the 19th November.

ON THE OXIDATION OF SULPHUR IN GAS BY COMBUSTION.

By W. C. Young, F.C.S.

In No. 8 of The Analyst* I published an account of some experiments, made for the purpose of ascertaining whether sulphurous or sulphuric acid was produced by the combustion of gas containing sulphur, the results of which led me to the conclusion that practically the whole of the sulphur present was converted immediately into sulphuric acid. This conclusion was afterwards borne out by Silliman and Sadler in a paper " on the volumetric determination of sulphur and ammonia in illuminating gas," which appeared in *The Journal of Gas Lighting*, vol. 29, p. 461, and subsequently by Heisch and Wigner in this journal.† Having this conviction, it seemed to me possible to absorb the acid fumes by passing the products of combustion over zinc in a fine state of division, by which means a very simple method of estimating the sulphur would be found as the difference in weight of the apparatus before or after use would be due solely to sulphuric acid. In attempting to put this into practice, I was surprised to find that the zinc was quite unaffected, except in places where moisture had condensed, and there sulphate had formed. I noticed, moreover, in the course of numerous experiments that wherever sulphate was, there also was carbonate to be found. This result casting some doubt on my former conclusions, I determined to investigate the subject farther, and avoid using any alkaline or basic substance as an absorbent of the acid. Accordingly, I first determined the amount of sulphuric acid contained in the water condensed in the gas referees' apparatus, used without carbonate of ammonia before and after oxidation with nitric acid, when I obtained an average of ·5 grains of sulphur per 100 cubic feet consumed, but in no case did I find an increase when the liquor was boiled with nitric acid previous to precipitation. As it was possible that the condenser was too hot to admit of the absorption of the acid by the condensed water, I next caused a fine stream of water to flow on to the glass balls in the cylinder by means of a modification of Bischof's constant level apparatus, used in his method of water analysis. A drawing of this apparatus will be found in a paper, by me, printed in *The Journal of Gas Lighting*, vol. 29, p. 464. It consists of an inverted flask, the neck of which is fitted into a tube narrowed towards the end to a fine bore, and fitted near its extremity with a stop-cock; on to this tube is blown at right angles another tube bent up again so as to be parallel with the former, and furnished near the top with a stop-cock. To use this apparatus, the flask is filled and the tube fitted firmly into its neck, the whole inverted and the lower stop-cock opened; when the flow of water ceases the delivery can be regulated to any desired rate by means of the upper stop-cock.

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* Vol. I., p. 43.

† Vol. III., pp. 133, 138.

The following results were obtained in this way:—

	Sulphur condensed as H_2SO_4 in grains per 100 cubic feet of gas consumed.	Total Sulphur in gas in grains per 100 cubic feet.
1.	·90	12·9
2.	·65	14·8
3.	·80	11·9
4.	1·26	12·8
5.	1·26	15·4
6.	1·31	14·6
7.	1·53	12·7
8.	·98	13·2

It seems, therefore, that either by using a larger quantity of water, or by cooling the cylinder, the amount of sulphuric acid condensed was somewhat increased but not to the extent expected, as fully half the space in the cylinder was kept quite cool during the progress of the experiment. This experiment was varied by carrying the end of the eduction tube of the referees' apparatus into the neck of another cylinder, on to the glass balls in which the water was run, so that the condensing power of the apparatus was vastly increased whilst using the same quantity of water as before.

The results thus obtained are as follows:—

	Sulphur condensed as H_2SO_4 in grains per 100 cubic feet of gas consumed.	Total Sulphur in gas in grains per 100 cubic feet.
1.	1·02	12·8
2.	1·01	16·1

A second estimation of the sulphur in the liquor obtained in these experiments was made after oxidation, but no increase was obtained. It was clear, therefore, that the means adopted were inadequate for the purpose of the complete absorption of the sulphur acids formed, but it seemed to me that if only sulphuric were formed these means were competent to arrest it; and to assure the presence of that acid only, I substituted bromine water for the water, using only one condenser, when the following results were obtained:—

	Sulphur in grains per 100 cubic feet of gas consumed.	Total Sulphur in gas in grains per 100 cubic feet.
1.	3·28	13·8
2.	5·20	12·4
3.	8·22	13·1

In these experiments the sulphur obtained as sulphuric acid increased with the bromine water employed, which in the last one was a saturated solution; as, however, a considerable portion of the sulphur had escaped condensation, a trial was made with the double apparatus before described, substituting bromine water for the water, when very similar results were obtained, as will be seen below:—

	Sulphur obtained in grains per 100 cubic feet of gas consumed.	Total Sulphur in grains per 100 cubic feet of gas.
1.	7·25	10·80
2.	7·32	9·48

It being evident that sulphuric acid could be absorbed from the mixture of gases by means of water, the inference drawn from the failure to obtain the whole of the sulphur was that the remainder escaped in the form of sulphurous acid, the means employed not being sufficient to oxidise the whole; accordingly I again varied the experiment by placing bromine under water beneath the burner, dispensing with the dripping apparatus, and substituting a reservoir of bromine under water in the upper *cylinder, formed by removing* the tube in the bottom and plugging the hole.

In this way I obtained more sulphur in the form of sulphuric acid, per 100 cubic feet of gas consumed, than was given by the method employed for estimating the total quantity of that impurity in the gas, as will be seen below :—

	Sulphur as $H_2 SO_4$ found by experiment as above described in gas per 100 cubic feet of gas.	Total Sulphur in gas by "Referees'" method in gas per 100 cubic feet.
1.	14·2	12·5
2.	13·8	12·4
3.	12·5	11·3

As some of the sulphur obtained may have been derived from the vulcanized rubber connections employed in these experiments they were repeated, cork being substituted for the rubber, when the results obtained were practically the same as those given by the usual method of estimating the sulphur.

Repeat of last experiment, cork connections substituted for vulcanized rubber :—

	Sulphur as $H_2 SO_4$ in grains per 100 cubic feet.	Sulphur by "Referees'" method in grains per 100 cubic feet.
1.	13·00	13·4
2.	9·28	9·2
3.	13·20	13·3

These results show beyond doubt that sulphurous acid only is formed when gas is burned in a Bunsen burner under the "Gas Referees'" apparatus, as the small quantity condensed as sulphuric acid by water alone may reasonably be assumed to have been oxidised during its passage through the aparatus. It is remarkable, however, that in all the experiments I have made where alkali or alkaline carbonate was used as the absorbent no trace of sulphite could be detected; that sulphurous acid cannot be detected in the water condensed in the cylinder, by the ordinary tests, and that when the cylinder is packed with zinc, or copper turnings, the whole of the sulphur is arrested, the resulting compound being invariably sulphate, and especially so in face of the circumstances that the air in the apparatus was formed to contain, on an average, only 12 per cent. of oxygen when the gas was burning at the rate employed, which was ·5 cubic feet per hour; but if any doubt could have remained as to the power of the current of hot air to oxidise the alkaline and other sulphites formed (by the action of sulphurous acid on carbonate of zinc or copper), the result of the following experiment must have entirely removed it. An alkaline solution of sulphite of soda, containing the equivalent of 5 per cent. of sulphur, was slowly run on to the glass balls in the cylinder of a Gas Referees' sulphur apparatus, the flame of a small spirit lamp being employed in the place of a Bunsen burner to produce the current of air, when it was found that the whole of the sulphite was oxidised into sulphate before it reached the bottom of the apparatus.

SOME OBSERVATIONS ON THE IODIC ACID TEST FOR MORPHIA.

(Abstract of Paper by DR. DUPRÉ, *from Guy's Hospital Reports, of 1863).*

Test solution employed—Iodic acid, 1 part in 15 parts water; starch, 5 grains boiled with 2,000 grains of water; ammonia, ordinary strength as used in testing, and the same diluted about 50 times.

Solutions of morphia or its salts, as nearly neutral as possible, give a yellow colouration, on addition of iodic acid; a tint is still perceptible when 1 part of morphia is present in 20,000 parts of solution. As long as the dilution is not greater than 1 in 600, a blue colouration is produced on addition of starch; below this strength the production of the blue becomes uncertain, and it fails altogether to make its appearance if the dilution exceeds 1 in 1,000. In the case of ordinary reducing agents, the blue iodide of starch is produced, even if they are so diluted that the yellow colouration, due to the iodine liberated from the iodic acid, is no longer perceptible. If to the mixture of iodic acid and morphia solutions an excess of ammonia is added, the yellow colouration produced by the iodic acid is, as shown by Lefort, considerably increased in intensity, and the colouration may, under these conditions, still be perceived in solutions holding no more than 1 part of morphia in 30,000 parts of solution. The colouration produced in ordinary reducing agents is discharged by ammonia. As stated above, mixtures of iodic acid and morphia, containing less than 1 part of morphia in 1,000 parts, no longer become blue on addition of starch. If, however, a very dilute solution of ammonia be carefully poured on to the surface of this mixture, which is best done by means of a fine pipette, two coloured rings make their appearance at the junction of the two fluids. A blue ring becomes visible in the lower acid layer, and a brown one in the upper alkaline portion; when the two layers are mixed the whole assumes a brownish colour. In this way the blue ring may be made visible in solutions containing only 1 part of morphia in 20,000 parts of solution. If a drop of the mixture of morphia and starch is carefully evaporated on a piece of white porcelain, and the dry spot, after cooling, is moistened with iodic acid, as little as 1-20,000th grain of morphia may be recognised by the blue colouration produced.

* THE NON-EXISTENCE OF NASCENT HYDROGEN.

By Dr. Donatto Tommosi.

The author has proved by very ingenious experiments that the so-called nascent hydrogen does not differ in any respect from ordinary hydrogen. Of the various experiments we will mention the most important.

1. A solution of chlorate of potash was treated for some time with sodium amalgam. The liquid was then neutralized with nitric acid and tested for chlorine with nitrate of silver, but no chloride of silver was produced, showing the nascent hydrogen does not reduce the chlorate.

2. The experiment was repeated, but this time with constant addition of some acetic acid to keep the liquid slightly acid. After six hours the liquid was tested with nitrate of silver, and found to be free from chlorine.

3. A saturated solution of potassium chlorate was acidulated with sulphuric acid and divided into two parts. The one was treated with zinc and the other with sodium amalgam. The fluids were both filtered before the free acid was neutralized. They were then both tested for chlorine. The one treated with the sodium did not precipitate with the silver, but the other gave a copious precipitate. It may now, perhaps, be thought the reduction of the chlorate was due to the nascent hydrogen evolved by the action of the zinc on the sulphuric acid, but the following experiment proves the reduction may be due, partly at least, to the zinc alone.

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* *Journal Les Mondes, T. XLVIII., No. 7.*

A very weak solution was so slightly acidulated with sulphuric acid as scarcely to act upon zinc. This solution was put into a U tube and decomposed by a galvanic battery, composed of eight Bunsen elements. The negative electrode consisted of platinum foil; the positive one of zinc foil. After two hours a little of the liquid (zinc side) was tested for chlorine, and it gave copious precipitate with silver, the other (platinum side) did not contain a trace. So from the experiment it appears that even electrolytic hydrogen does not reduce the chlorate, but the reduction was caused by the zinc. In order to prove this still more conclusively the experiment was repeated with a platinum electrode instead of the zinc one, and no trace of chloride was produced even after 20 hours.

The author found it impossible to reduce perchlorate of potash with so-called nascent hydrogen prepared by any of the known methods.

Whenever so-called nascent hydrogen reduces, it is because it happens to be accompanied by a sufficient amount of heat evolved during the chemical action of the substances which yield the hydrogen, but not because it possesses other properties than ordinary hydrogen. The author also considers it highly improbable the nascent hydrogen should consist of isolated atoms of H.

GAS REGULATORS.

A NEW form of gas regulator, or governor, originally designed merely for application to street lamps, has been brought under our notice. It appears to possess special advantages for laboratory use in the perfection with which it regulates the supply of gas under varying pressures.

The inventor, Mr. Borrodaile, has discarded the ordinary flexible diaphragm, and constructs the governor entirely of metal. For sizes constructed to pass five feet or less per hour, the apparatus consists of a small brass cell carefully turned inside. The diameter of the cell is nearly that of an ordinary shilling, and it is about one-third of an inch deep. The inlet and outlet pipes for the gas pass into the top and bottom of the cell. The only movable part is a thin flat metallic disc, turned so as to fit the cell accurately, though loosely enough to vibrate freely. This disc carries a short metallic tube about a quarter of an inch long, which serves as a guide to ensure the parallel motion of the disc, and also as the tube through which the gas passes from the lower part of the cell to the upper. The regulation is effected by the rising or falling of the disc. When the pressure rises, this disc, carrying with it the metallic tube through which the gas passes, rises also, and by bringing the end of the tube nearer to a fixed plate, partially cuts off the supply of gas, similarly, when the pressure is diminished, the plate falls and the gas way is increased.

Simple as the invention is, it works better than the ordinary governors, as the following experiments will show.

Three burners, nominally four feet, were attached to the same pipe, under a gas pressure of 9-10ths of an inch. The consumption of the three was 11·7 feet per hour, or an average of 3·9. The gas pressure was suddenly increased to 19-10ths, and it was impossible to detect any difference in the illuminating power.

One governor with burner attached was tested separately.

Under a pressure of 9-10ths inch it passed 3·87 C.F. per hour.
„ „ 19-10ths „ „ 3·82 „

The orifice of the burner (an ordinary batswing jet) was reduced to less than half its area by putting a thick piece of paper in the slit.

Under a pressure of 9-10ths inch it passed 3·85 C.F. per hour.
„ „ 19-10ths „ „ 3·80 „

A test was made another day at higher pressures, and the following results were obtained:—

Under pressure of 9-10ths, a burner passed 3·80 C.F. per hour.
„ „ 30-10ths, „ „ 3·70 „
„ „ 50-10ths, „ „ 3·67 „

Another governor, made to pass more than 30 cubic feet per hour, was connected with four of the largest-sized Bunsen burners and used to heat a steam bath. Under a pressure of 19-10ths the consumption was, when all four burners were turned on, 33-ft. per hour; when only one burner was turned on, 32·5-ft. per hour. We have been using it very successfully for regulating the supply of gas to air drying baths, and are testing it for regulating the currents of air in gas washing experiments.

In will be found valuable in the laboratory in many other ways.

SPECIFIC GRAVITIES OF FATS, RESINS, ETC.

By Dr. H. Hager.

The author first describes a simple method for determining these specific gravities. This consists in melting the respective fat, dropping it into a flat-bottomed vessel containing alcohol, in such a manner that the point from which the drops are allowed to fall is not over three centimetres distant from the surface of the alcohol, and that each drop be allowed to fall on a different spot. The fat globules thus deposited at the bottom are then removed to a liquid, consisting of either alcohol, water or glycerin, or mixtures of these, until after careful stirring and reduction or increase of the density, by the addition of one or another of the above liquids, the fat globules are held in equilibrium in any part of the liquid. The specific gravity of the latter is then determined, and this is, of course, at the same time the specific gravity of the fat. The author then gives a list of specific gravities, which is here reproduced:—

	Sp. gr. at 15—16° C.
Butter Fat, clarified by settling	0·938—0·940
„ „ several months old	0·936—0·937
Artificial Butter	0·924—0·930
Hog's Lard, fresh	0·931—0·932
„ „ old	0·940—0·942
Beef Tallow	0·925—0·929
Sheep's Tallow	0·937—0·040
Beef and Sheep's Tallow, mixed 1:1	0·936—0·938
Butter of Cacao, fresh	0·950—0·952
„ „ very old	0·945—0·946
„ and Beef Tallow, mixed 1:1	0·938—0·939
Expressed Oil of Nutmegs	1·016—1·018
„ „ „ extracted with carbon disulphide	1·014—1·015
„ „ „ adulterated with fatty acids	1·010—1·011

	Sp. gr. at 15—16° C.
Expressed Oil of Nutmegs, crystalline	0·965—0·966
Stearic Acid, melted and in drops	0·964
„ „ crystalline	0·967—0·969
Wax, yellow	0·959—0·962
„ African	0·960
„ yellow and resin, mixed 1:1	0·973—0·976
„ „ and paraffin, mixed 1:1	0·916—0·919
„ „ „ yellow ceresin, mixed 2:1	0·942—0·943
Ceresin, yellow	0·925—0·928
Wax, Japan	0·977—0·978
„ „ very old	0·968—0·970
„ white, very old and true	0·963—0·964
„ „ new	0·916—0·925
„ „ „ and stearic acid, mixed 1:1	0·945
Wax, sp. gr. 0·963 and stearic acid, sp. gr. 0·963 mixed 1:1	0·975
Ceresin, very white, pure	0·905—0·908
„ white	0·923—0·924
Araucaria Wax	0·990
Resin (fr. pine), yellow transparent	1·083—1·084
„ whitish, opaque	1·044—1·047
„ very dark colophony	1·100
Shellac, light coloured	1·113—1·114
„ darker	1·123
„ bleached	0·965—0·968
Dammar, old	1·075
Copal, East Indian	1·063—1·070
„ West Indian	1·070—1·800
„ very old	1·054—1·055
Benzoin, Siam	1·235
„ Penang	1·145—1·155
„ Borneo	1·165—1·170
Guaiac Resin, pure	1·236—1·237
Amber	1·074—1·094
Sandarac	1·038—1·044
Mastic	1·056—1·060
Balsam of Tolu, old brittle	1·231—1·232
(Kamala	1·115—1·120)
(Lycopodium	1·016—1·020)

Many of these figures may be used as criteria for distinguishing the various bodies.—*New Remedies.*

ALUM IN BAKING POWDER.

In a recent issue of the *Scientific American Supplement* will be found a communication from G. E. Patrick, Professor of Chemistry in the University of Kansas, giving details of a series of practical tests to determine whether the hydrate of alumina is dissolved by the gastric juice. The question has a vital bearing on the discussion as to the safety of using alum in baking powders. Professor Patrick attacks it without prejudice, by strictly scientific methods, and arrives at results which are certainly gratifying in view of the wide use of alum powders in our kitchens.

Professor Patrick takes his text from the published opinion of a prominent physician who says, after stating the difficulties attending a thorough mixture of the ingredients of alum baking powders:—"But even if the exact proportions were maintained, the salts formed would retain their injurious properties, as they would dissolve in the gastric juice. The gastric juice contains not only lactic acid, but a large amount of hydrochloric acid, and both the sulphate and hydrate of alumina would be dissolved."

After testing by reference to authorities the statement that the gastric juice contains a large amount of hydrochloric acid, and finding the weight of evidence to be that the quantity is in reality extremely minute, and that little not free, Professor Patrick proceeds to describe his examination of the practical question whether the hydrate of alumina as it exists in bread after baking, when made with alum powders, will be dissolved in the fluids of the alimentary canal.

This question could be determined only by careful tests with living animals. Professor Patrick found cats to be most available. Having made biscuits with an acknowledged alum baking powder, using twelve times the proportion of powder directed on the labels, and employing for each experiment a distinct sample of powder, he fed the biscuits to cats that had fasted from one to two days. The amount eaten in each case was enough to give at least half a teaspoonful of powder to each experiment. After allowing for digestion 20 minutes, 45 minutes, 1½ hours, 2 hours, and 2½ hours, respectively, the cats were killed, and the contents of the stomach and small intestines were carefully examined for dissolved alumina. In each case undissolved hydrate of alumina was found, but of dissolved alumina there was never a trace.

Surprised at the uniformity of these results, and thinking that the organic matter of the flour might have interfered with the solution of the alumina or his detection of it, Professor Patrick made two crucial experiments. In each, two teaspoonfuls of the powder were mixed with water and baked at the ordinary temperature of the oven. The mass was then fed to a cat (under compulsion) and after a specified time the stomach and intestines were examined as before. In neither case was a trace of dissolved alumina discovered.

Similar experiments were then tried with unbaked (gelatinous) hydrate of alumina, and in these cases a trace of dissolved alumina was found; the inference being that it is not safe to eat dough made with alum powder—it should always be baked. Another important practical point was also suggested—namely, that if bread is carelessly mixed or with insufficient water, some of the powder may remain dry and the alum not changed to the hydrate; in which case the effect would probably be injurious.

In order to test this question, and also to furnish a check on the other experiments with biscuits, Professor Patrick had a batch made in which the mixing was less thorough than usual and with less water. These were fed to cats, and subsequent tests developed in every case a trace of dissolved alumina. These experiments, while proving the reliability of those first described, go to show, Professor Patrick thinks, that to insure the entire absence of alum in the bread, the mixing must be done with plenty of water. As a simple precaution it might be well to mix the batter too thin at first, and stiffen it by the addition of pure flour.*—*New Remedies.*

Mr. J. Baynes has been appointed Public Analyst for the Borough of Boston.

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* We do not find, however, that Professor Patrick's experiments contain any reference to the effects which might be produced by the insoluble alumina.—[Eds. ANALYST.]

A NEW METHOD OF PREPARING SULPHURETTED HYDROGEN.

By J. Fletcher, F.C.S., London and Paris.

Any mode by which the preparation of this useful gas can be rendered easier, and the unpleasantness of its manipulation diminished, will no doubt be welcomed by analysts: I therefore make no apology for submitting the results of some experiments made after reading a suggestion in some of the scientific journals, perhaps your own, but the name does not at the moment occur to me.

The plan is simply to fuse in a small glass flask sulphur and solid paraffin, leading the resulting gas by means of a perforated cork, india-rubber, and glass tube directly into the solution to be tested. The first gases are not sulphuretted, but when the mixture has been thoroughly fused and mixed the sulphuretted hydrogen passes over abundantly.

The advantage of the process is that the moment the flame of the lamp is removed the evolution of gas ceases, and the little apparatus can be laid aside without fear of creating offensive smells. When used again, the gas passes at once when sufficiently heated.

A washing bottle seems unnecessary. I passed the gas for an hour through such a bottle, and the water, although most strongly impregnated with the gas, was fairly clear and limpid, showing only the usual appearances.

There are a few precautions to be taken. The mixture is inclined to bump when strongly heated, but a few pieces of broken tobacco-pipe shank prevent that. Care must be taken that when the lamp is removed, and the gas ceases to pass, that none of the solution is sucked back into the bulb; it is very easily prevented. A very strong heat should not be applied, as then distillations would commence and the product condense in the tube.

I believe the process to be a simple, cleanly, and elegant substitute for the old methods, and particularly well suited for small and private laboratories. How it would work in large ones I would like to hear from those who are in a position to try it.—*Chemical News.*

Referring to the above note the following letter has appeared in the *Chemical News* :—

To the Editor of "The Chemical News."

Sir,—In the *Chemical News*, vol. xl., p. 154, Mr. J. Fletcher has described what he calls a new process for the preparation of H_2S by melting sulphur and solid paraffin together. Allow me to state that the process is not new, having been used by myself and others as far back as 1872. I continued to use it for more than twelve months, but found it very unsatisfactory, because of its explosive qualities, and upon that account gave it up. As far as I remember an explosion took place about every seventh experiment; at one time the cork of a flask would be violently ejected and the contents sent to the ceiling, at other times the flask was completely destroyed.

The process works remarkably well except for this one fault, and if Mr. Fletcher has succeeded in overcoming its explosive qualities by the addition of broken tobacco-pipe shanks he has indeed rendered a service to chemists in general.

I am, &c.,

WILLIAM JOHNSTONE, F.I.C., F.C.S.

Wiesbaden, September 29th, 1879.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—If we are to believe some of our would-be teachers, there are—to paraphrase one of Carlyle's well-known sayings—in these islands about a hundred Public Analysts——mostly fools.

Under these melancholy circumstances, the Pharmaceutical Society has apparently undertaken the task, through its paid professors and editor, of educating us for our work. Unfortunately, no doubt owing to my belonging to the majority, I often fail to understand either the chemistry, the sense, or the morality of the teaching. Can any one belonging to the minority enlighten me?

In the *Pharmaceutical Journal* for September 27th, I find Dr. Paul reported as stating in evidence, that "the presence of tartrate of lime in cream of tartar was indicated by the *British Pharmacopœia;*" and in an editorial article in the same number it is said, that the fact that tartrate of lime is a natural ingredient of cream of tartar is recognised in the *British Pharmacopœia.* Now, bearing in mind that the evidence was given in defence of a person accused of having sold cream of tartar adulterated with 11·7 per cent. of tartrate of lime, I turn to my *British Pharmacopœia*, and what do I find? That the presence of traces of a calcium salt, not specially of tartrate of lime, in cream of tartar is recognized, and that traces only are meant, is placed, as I read the book, beyond a doubt, by both the qualitative and the quantitative test given. Professor Redwood's letter on this subject is, I must confess, beyond my powers of understanding; but it requires I suppose the highly-trained intellect of a pharmaceutical chemist for its comprehension.

In the number for October 18th, I find among other the following evidence of Professor Attfield reported. "There was enough soda to warrant the name—it was about ¼ of a grain." "On account of the rapidity of the manipulation of the work by the boy in putting the soda into the bottles, I should certainly expect the quantity to vary from say ¼ of a grain to 3 or 4 grains." Why not from nothing to——. No doubt the poor milkman is often punished, because in his hurry he has merely forgotten to empty his can of the water he used in washing it; and the poor grocer because he has ground first chicory and then coffee in the same mill, and has simply forgotten to clean it between the operations, &c., &c. "The soda dropped into one of the bottles falls on the glass ball, sometimes partly, sometimes mainly; and then, when the water charged with gas is driven by the machine into the bottle, air and gas escape from the neck of the bottle, and with that air nearly always comes out some spray, and with that spray might come a certain amount of soda." What may not have been carried away by that spray? "I then pressed down the ball and got out the liquid, and found lead therein. I immediately examined the particles of wax for lead, and found lead in considerable quantity." Astonishing! When asked, "Do you consider the lead in the sample innocuous?"—he answers, "Perfectly; such a minute quantity must be." Would Professor Attfield be kind enough to give us the exact composition of the residue left by this sample of soda water; and also the method which enabled him to state, positively, that the water contained about a ¼ of a grain of added soda per bottle? Also, would he inform us whether, in his analyses and reports on potable water, he considers 1-20th of a grain of lead per gallon as necessarily innocuous?

In the same number (18) the certificate of the analyst is given, in which it is stated:—"This sample is ordinary water charged with carbonic acid gas, and does not contain added bicarbonate of soda, and is not soda water." In his evidence, Mr. Thomas is reported to have stated in answer to the question: "Supposing it contains only 3 grains?"—"It would still be soda water." But what says the editorial article? "The Newport analyst followed the example of many of his brethren in arriving at the conclusion that the *British Pharmacopœia* furnished a standard for the composition of soda water,—that if it did not contain in the half-pint 15 grains of carbonate of soda, it was not of the nature and quality of 'soda water.'" But enough for the present; and, in conclusion, I would only ask: Are we to accept such teaching as the above? Are pharmaceutical chemists trained in this way to supplant the 'too often incompetent Public Analyst?"—*vide* Professor Tilden's speech before the Pharmaceutical Society, October 1st, 1879; and, finally, does the Council of the Pharmaceutical Society sanction and approve this kind of teaching?

Yours truly,

A. DUPRÉ.

THE IODIC ACID TEST FOR MORPHIA.

To the Editor of "The Analyst."

Sir,—When writing a note upon the above last month, I find I was mistaken. I was under the impression that ammonia was to be added to the bisulphide of carbon containing the dissolved iodine; instead of that, the ammonia is to be added to the iodic acid and morphia.

Dr. Dupré kindly called my attention to the error which I had fallen into, and also referred me to a paper which he had published upon this subject some years since, no notice of which I believe has been taken in any of our text books. I have been carefully over his paper and the results are as stated.

I consider Dr. Dupré's paper a model of clear statement; one cannot well fall into error with such a guide; it would be well if our text books on analytical chemistry were as clear.

Yours truly,

J. CARTER BELL.

ANALYSTS' REPORTS.

Mr. Wigner reports to the Plumstead Board of Works as follows:—"During the quarter I have examined 34 samples; only three of these were adulterated. The adulterated samples were all milk, and contained 7, 15 and 15 per cent. respectively of added water. Two samples of butter were of very inferior quality though not adulterated. The milk supply still continues unsatisfactory; three samples is a very large percentage out of 10 to be adulterated, bearing in mind that this adulteration is calculated in every case on a very lenient standard." Reviewing the results of the last six years, he says:—"The total number of samples purchased by the Inspectors and submitted to me during that time has been 801, of which no less than 90, or 11·2 per cent. have been adulterated. The samples of adulterated milk were 53 in number, or 59 per cent. of the total. Groceries, including tea, coffee, mustard, cocoa, &c., and butter were 23, or almost exactly one-fourth of the total number. There were five samples of adulterated bread, and nine of adulterated spirits. The percentage of adulteration found in the six consecentive years have been as follows:—1874, 14½ per cent.; 1875, 11 per cent.; 1876, 6½ per cent.; 1877, 9 per cent.; 1878, 16½ per cent.; 1879, 7½ per cent. The only way in which I can account for the remarkable increase shown in the figures for 1878 is, by supposing that the difficulties which had occurred in prosecution, owing to a misinterpretation of the Act, rendered dealers less cautious."

At the monthly meeting of the Salford Town Council, the Public Analyst (Mr. J. Carter Bell) presented the following report:—During the quarter ending September 30, I have examined 140 samples, consisting of 120 of milk, 15 of butter, 2 of flour, 1 of tea, 1 of sweets, and 1 of port wine. Of these 32 were adulterated, consisting of 28 of milk, 3 of butter, and one of wine. It will be noticed that milk adulteration has increased, nearly 25 per cent. of the samples having been adulterated. Much has been written in the papers lately upon the manner in which samples of milk are taken. It has been proposed that the adulterated milk should be traced to the guilty party, and this was suggested as a novelty at the last meeting of the British Association, whereas it has for a long time been my practice to track out the real culprit. Thus in Salford, whenever a sample of milk is found to be adulterated, the inspector at once inquires whence the vendor obtains the milk. A sample is then procured from the wholesale dealer, and if that is found to have been tampered with, the inspector obtains samples from the cans of the farmer who supplies the milk immediately on its arrival in Salford. If this corresponds to the former samples, I then make a point of seeing the cows milked myself, and analyse the sample which has been obtained in my presence, so as to leave no chance of an innocent person being convicted. The inspector spares no pains or trouble in finding out the real delinquent. He has taken several samples on Sunday, when the milkman thought he was in church. One of the samples of milk obtained on that day contained as much as 35 per cent. of water. The sample sold as port wine contained more spirit than any sample I have previously examined or found in any published analyses. It also contained more cream of tartar, tartaric acid, and sugar, and the colouring matter was artificial. Taking all these facts into consideration it is my opinion that this so-called wine is perfectly innocent of the juice of the grape.

The Cheshire Analyst (Mr. Carter Bell) reported to the Quarter Sessions that he had examined during the quarter 123 samples, including 62 milks, 4 tobaccos, three lards, 6 coffees, 2 peppers, 1 butter, 1 mustard, 1 cocoa, 1 cheese, 1 flour, 2 oatmeals, 9 teas, and 2 breads; the remainder consisting of water and alcoholic drinks. Eleven samples were adulterated, viz., 8 milks, 1 butter, 1 gin, and 1 cocoa.

At the Devon Sessions, the County Analyst (Mr. A. Blyth) reported that during the quarter he had examined thirteen specimens of food, and had found but one case of adulteration, namely, that of an admixture of chicory with coffee.

LAW REPORTS.

Notice as to Mixture.—At the Salford Police Court, William Hampson, milk dealer, West George Street, was summoned for selling adulterated milk. Mr. Walker prosecuted on behalf of the Corporation, and Mr. Gardner appeared for the defendant. Mr. Walker stated that on the 29th July a boy named Thompson, son of the inspector under the Sale of Food and Drugs Act, visited the defendant's shop and asked for a pint of new milk. He was supplied by the defendant, and paid 1¼d. for it. After having purchased it, he told the defendant that he had bought it for the purpose of having it analysed, and the defendant in reply directed his attention to a card which was hanging up in the shop upon which were the printed words, "This milk is sold as a mixture of milk and water." The boy then took the milk to his father, who was outside waiting for him. He (Mr. Walker) presumed that the defendant was alive to the offence, inasmuch as he had the card hung up stating that he was selling a composition of milk and water. The 8th section of the Sale of Food and Drugs Act only protected persons in cases where the addition of any compound was not made for the purpose of fraudulently increasing its quantity. The addition of water was not necessary for the sale of the milk, and it could only be made for the purpose of increasing the quantity of the milk. The above facts having been corroborated by Inspector Thompson and his son, Mr. Makinson remarked that the inspector's son knew he was purchasing milk and water, and therefore he was not prejudiced. The boy was an agent to all intents and purposes, and knew that he was going to receive milk and water. Mr. Walker submitted that the boy was an independent person. Mr. Makinson took an opposite view, and elicited from the inspector that he gave his son the money to pay for the milk. He (Mr. Makinson) thought it was just possible that the notice hanging in the shop—a rather dark room—was not sufficient to enable everyone to see that a mixture of milk and water was being sold. According to the evidence the defendant did not notify to the inspector's son that the card was there until the latter informed him that he was buying the milk to have it analysed, and he (Mr. Makinson) was, therefore, of opinion that the card was not a proper notice to everyone going into the shop to buy milk. When a man chose to carry on a trade in a risky manner as the defendant had done, he ought to tell everybody—any new customer—going into the shop that he sold milk and water if milk was asked for. In the present case, however, the inspector's son knew that what he was buying was milk and water. The summons was dismissed. Mr. Gardner: I may say now that he told the boy, and we tell every customer, that we sell milk and water. Alfred Riley, provision dealer, Paradise Street, Salford, was summoned for a similar offence. Inspector Thompson stated that on the 5th August he called at the defendant's shop and bought a pint of milk for which he paid 1¾d. He divided it into three parts, and sent one part to the Public Analyst for analysis. Mr. Carter Bell Public Analyst, said he had examined the milk referred to, and found it contained 10 per cent. of water. The defendant's plea was that he sold the milk in the same condition as it was when he bought it. Mr. Makinson said the defendant was bound to know that the milk he sold was good milk, and fined him 5s. and costs.

Adulterated Butter.—At the Clerkenwell Police Court, Charles Sterland, butterman, of 39, Central Street, St. Luke's, was summoned for having sold adulterated butter. Mrs. Robins said that she bought three-quarters of a pound of butter at the defendant's shop, and when Mr. Edes entered, the defendant said it was not sold as butter, and there was a stamp on the paper used as a wrapper to that effect. The butter was sold at 1s. 2d. a pound. Mr. Ricketts, for the defence, said that a person could not be convicted under the Act if he caused a legible notice to be given to the purchaser that the substance was not entirely butter, as long as the added matter was not hurtful. Mr. Edes said that in this case the substance was not butter at all, for it was composed entirely of other fatty matter. The magistrate having examined the paper in which the butter was wrapped, said the stamp was nearly illegible. Mr. Ricketts contended that this was caused by the sanitary inspector having scraped the butter off the paper with a knife. The defendant produced a stamp and printing ink, which he used to mark the paper in which he sold the butter. He had been prosecuted last May, and since then he had been very careful to let the public know what they purchased. He sold a great quantity of the butter, and his customers always knew what they bought. He called two witnesses to prove that the paper was stamped when the butter was sold to Mrs. Robins. Mrs. Robins said that she had not seen the paper stamped, and it was not until the defendant referred to the matter that Mr. Edes saw some writing, and then he could not read the letters. The magistrate said that as the evidence was conflicting he should only impose the cost of the prosecution on the defendant.

Adulterated Milk.—Frederick Gerring, of 31, Eversholt Street, Camden Town, was summoned at the instance of the St. Pancras Vestry, for having, on August 12th, sold a pint of milk adulterated with water, to the prejudice of the purchaser. Mr. Ricketts appeared for the prosecution; and Mr. Wakeling defended. The milk was purchased in the presence of Mr. Roach, Sanitary Inspector for St. Pancras, it being analysed by Dr. Stevenson, Public Analyst. It was found to have been adulterated to the extent of 15 per cent. of added water. It was stated that the defendant was the owner of a hundred cows, and that he was in a large way of business. The milk was purchased from a man employed by the defendant, who sold it from a barrow in the street. Mr. Wakeling contended that the milk had not been divided into the customary three parts by the inspector in a fair manner, and not properly in the presence of the vendor. The magistrate fined the defendant 40s. and 12s. 6d. costs. The fine was paid, but the defendant gave notice that he would appeal against the decision.

Prosecution by the Metropolitan Dairymen's Society.—At the Edmonton Petty Sessions, Edward Gudgeon was summoned by Mr. A. Parish, Inspector of the Society, for selling to him adulterated milk on the 1st of August. The certificate of Dr. Redwood, the Public Analyst for the County of Middlesex, was put in, and it certified that the milk was adulterated with 26 per cent. added water. Defendant pleaded not guilty, and said he could not be answerable for the milk after it was taken from his house. The inspector bought it of his servant in the street. Alderman Abbiss (the chairman) informed him that he was answerable for his servant. Mr. Peckham, who appeared for the prosecution on behalf of Mr. Ricketts, informed the magistrate that the inspector purchased a sample at the shop which was adulterated; but the society did not wish to go on with that. The magistrates said it was a most serious case, as the milk was adulterated to the extent of one-fourth, and the defendant was liable to £20 penalty, but being the first time of his being before them they should fine him only 40s. and 21s. costs.

Adulterated Cream of Tartar.—At the Chertsey Petty Sessions on September 24th, George Boyce was summoned for selling to Frank Walters a certain drug, to wit, 2 ounces of cream of tartar, to his prejudice, on the 19th of August. Mr. A. Haynes appeared for the defendant. Police-constable Waters said: On the 19th of August he went to Mr. Boyce's shop and asked for 2 ounces of cream of tartar and was served by the assistant. He paid 4d. for it. After receiving it he told the assistant it would be handed over to Supt. Bungard, who would take it next day to Guy's Hospital to be analysed. Witness asked him if he would like to keep a portion of it. The assistant said that he did not wish to do so. Witness then sealed it up in his presence and afterwards handed it over to Supt. Bungard. Supt. Bungard said: On the 19th of August he received 2 ounces of cream of tartar from last witness, and on the 21st took it to Guy's Hospital. He produced Dr. Stevenson's certificate, which stated the cream of tartar to contain 11·7 of tartrate of lime and ·6 of sulphate of baryta, and that the foreign ingredients were insoluble and not injurious to health. Mr. Haynes addressed the bench and called Mr. Hodgkinson, of the firm of Hodgkinson and Co., Aldersgate Street, who said that defendant and his father before him had been customers of his firm for many years. Mr. Boyce was very particular, and was always supplied with the very best drugs. The cream of tartar which was the subject of the present case he had reason to know came from Messrs. Hodgkinson's stores. Cream of tartar was sent to this country from Spain and France and came in a state that was known as argol, and was consigned from the brokers to the manufacturers. The argol was generally taken from the docks by the grinders. The cream of tartar in question came into the market in the usual way and was ground by Messrs. Stafford, Allen and Sons, who returned it to his firm and they sent it out as it was purchased. Messrs. Allen and Sons were the only grinders of the drug. The article sent to Mr. Boyce was the very finest that could be obtained. Argol, or cream of tartar, was the natural product of the fermentation of the juice of the grapes. It was impossible to have cream of tartar without tartrate of lime, and he was informed from the best authority that it was generally found in quantities of from 10 to 20 per cent., and the lowest he ever heard of was 7 per cent. He recognized the sample of cream of tartar produced from its very fine grinding. It could not be obtained finer. He could not account for the very small amount of baryta being with the drug, but had seen it with cream of tartar before. Mr. E. R. Allen, of City Road, London, said his firm received a delivery order to obtain the cream of tartar in its crude state. It was then ground and sent to Messrs. Hodgkinson, and nothing was added to it. Mr. G. Boyce said he purchased the drug of Messrs. Hodgkinson and sold it as he received it. He believed it was the best quality that he could possibly buy. Dr. Horatio Paul, F.C.S., said the term "cream of tartar" was, according to the *British Pharmacopœia*, a synonym for acid tartrate of potash. The article referred to was the medicinal form of acid tartrate of potash and that met with in commerce. It consisted essentially of the compound of tartaric acid with potash, together with some varying proportion of tartrate of lime, which was incidental to the manufacture of cream of tartar in the usual way. The presence of tartrate of lime in cream of tartar was indicated by the *British Pharmacopœia*. Sulphate of baryta was an extraneous impurity, but it was scarcely conceivable that so small a proportion as that indicated by the analyst's certificate could have been intentionally added as an adulteration. The only other possible explanation of its presence was accidental admixture; but it was an inert substance not injurious to health, and the trifling amount present did not sensibly affect the medicinal efficacy of the cream of tartar or its intrinsic value. The Chairman said the Bench were unanimous in dismissing the case.

Sending Samples by Train.—At the Hanley Police Court, on September 24th, James Paine, yeast seller, Stoke, was summoned by Mr. Lewis, inspector under the Act, for having sold some yeast which on analysis was found to be adulterated with 30 per cent. of potato starch. Mr. Ayre supported the complainant, and Mr. Sword defended. Mr. Lewis spoke to making a purchase of half a pound of yeast from the defendant, who was selling it at Northwood. He told the defendant it was intended for analysis. He forwarded a portion of the yeast to the Borough Analyst by train. In cross-examination by Mr. Sword, the witness said he did not say what analyst the yeast would be submitted to. Mr. Sword thereupon contended that the case broke down, as the act prescribed that the name of the analyst should be given to the seller. His objection was subsequently overruled on the production of a circular, a copy of which the inspector had given to the defendant at the time of the purchase, in which the Public Analyst for the Borough was specified. Mr. Hamshaw said there was another objection. The Act provided for the personal delivery of samples to the analyst unless he lived at a greater distance than two miles, in which case the samples might be transmitted through the registered post. The sending of samples by train was consequently irregular. Mr. Ayre submitted that the transmission by rail was also a legal delivery. Some articles, such as bread, milk, or pickles, could not be sent by post, and as the Borough Analyst resided at Hull, it would be expensive to take them. Mr. Hamshaw said that in cases of samples that could not be posted personal delivery was necessary. The bench thought the objection fatal, and dismissed the case, but, on the application of Mr. Ayre, promised to grant a case on the point, if he, on consideration, should request one. There was another summons in which Andrew Riley was charged with selling adulterated yeast. The same circumstances as to delivery existed in this case, and the summons was withdrawn.

Impure Milk in Salford.—At the Police Court, before Mr. Makinson, Jno. Taylor, farmer, Cadishead, was summoned for having sold adulterated milk. The assistant-clerk (Mr. Walker) prosecuted, and Mr. W. Cobbett was for the defence. The evidence for the prosecution showed that on the 9th September the inspector took a sample of milk from a milk dealer named Bardsley, in Hough-lane, Broughton, and upon being analysed it was found to contain 16 per cent. of water. The inspector subsequently, from what Bardsley told him, accompanied him to the Central Station on the morning of the 11th September, and took a sample of the milk consigned to him by the defendant Taylor, and this being analysed was found to contain water in the same proportion as that Bardsley was selling when a sample of his milk was taken. Taylor was said to be the only person who supplied Bardsley with milk at the Central Station. The inspector stated that on the morning in question he saw the cans arrive at the Central Station. Bardsley, in answer to Mr. Cobbett, said he had been fined £10 and costs for selling adulterated milk. For the defence, witnesses were called to show that the milk was sent from the defendant's farm in a pure condition, and that it was sent on the evening of the 10th September, and must have arrived in Manchester the same night, Bardsley leaving it there until the next morning. The summons was dismissed.

A summons charging James Hunt, farmer, of Croft, near Warrington, with a similar offence, was then heard. Mr. Walker prosecuted, and Mr. Gooden defended. The evidence was to the effect that, on the 11th September, the inspector went with Bardsley from the Central Station to the Ordsal Lane station, where had arrived some little time previously two cans of milk consigned to Bardsley by the defendant. The inspector took two samples of the milk in Bardsley's presence, and the defendant was afterwards warned that his milk had been analysed and he might have a portion of the sample on application at the Town Hall. The defendant's solicitor now contended that the taking of the sample was informal, as the sample offered to them on application at the Town Hall was not sealed, and as at the time it was taken it was not "then and there sealed or otherwise securely fastened" as required by the Act, and said that instead of the sample being kept it should have been returned in the empty can to the defendant. Mr. Makinson, after hearing the evidence of the defendant who swore that the milk was pure when despatched, said he had some doubts in the case. After some little discussion of the various points in the case, the hearing was adjourned.

At the adjourned hearing, a witness named MacLeod, who assisted the defendant and conveyed the milk to the station, was called. He stated that on the day in question it was despatched in a perfectly pure condition. A female witness, named Law, and who said she had been in the defendant's employment 13 years, stated that she assisted to measure the milk sent from the farm, and that she cleaned the cans. No water was ever mixed with the milk. Mr. Makinson said he had so much doubt in the case that he should dismiss it. It was possible for the milk to have been tampered with at the station between the time of its arrival and the time the inspector called. Having also regard to the penalty which had been previously imposed on Bardsley, and to the fact that it was greatly to his interest to endeavour to show adulteration on the part of the farmer, he could not come to the conclusion that the adulteration had been made at the farm. The case was accordingly dismissed.

The next case heard was that against Wm. Bennion, of 36, Brown Street, in which he was charged under a summons with selling adulterated milk. Inspector Thompstone said that on the 5th September he took a sample of the defendant's milk. He divided it into three parts in the usual way. The defendant told him at the time that he had got his milk from the man Bardsley mentioned in the last case. Mr. J. C. Bell, the Borough Analyst, stated that he received a sample of the milk in question from the last witness, and upon analysing it found it to contain 23 per cent. of water. The defendant said he had nothing to say, except that the milk was as he had received it from Bardsley. Mr. Makinson said it was no doubt true that Bardsley had been selling adulterated milk, whether knowingly or not, but the defendant was liable because he should exercise great care as to what he sold. He did not think it a bad case. The defendant would be fined 5s. and costs, or have seven days' imprisonment.

Jas. Bardsley, Hough Lane, the milk dealer mentioned in the previous cases, then answered to a summons which charged him with selling adulterated milk. Inspector Thompstone said that on the 9th September he took a sample of the defendant's milk at the time the defendant's son was delivering milk to the defendant in the last case (Bennion). Mr. Bell said upon analysis he found the samples of milk to contain 16 per cent. of added water. The defendant declared upon oath that he delivered his milk to his customers as he had received it. Mr. Makinson said he should treat the defendant's as an ordinary case. He should not deal with him as if it had been proved that the milk was delivered to him perfectly pure. A fine of 40s. and costs was inflicted.

A Deceiving Label.—At the Worship Street Police Court, lately, Mr. James Wilkins, cheesemonger, of High Street, Hoxton, appeared to a summons, taken out by the parish authorities, for selling adulterated butter. Mr. Fletcher, a sanitary inspector of the parish, proved purchasing a pound of butter at the defendant's shop, and the certificate of the analyst, put in, showed that it was adulterated to the extent of 75 per cent. The defendant produced a placard, framed and glazed, which set forth that he would not be answerable for the butter sold at his "establishment" being pure and unadulterated. The inspector said that the butter from which he was supplied was labelled "This is butter." He did not see the placard produced. The defendant said he had not any label bearing the words "This is butter," but he produced two, one bearing the words, "Oh, mother, look! 1s.;" the other, "This is better, 1s. 2d." The ticket bearing the word "better" was the one, he said, the inspector had mistaken for "butter." Mr. Bushby examined the placard and label, and said that the "e" in "better" was so rubbed that anyone might have taken it for a "u." The placard was also artfully contrived to deceive the passer by; for such words as "pure and unadulterated" were set out in large red letters, while the context, notifying that the defendant would not be responsible for the butter, was small and black, and rubbed. He thought the present a clear case of intention to defraud, and therefore ordered the defendant to pay a fine of £5, or suffer two months' imprisonment. The money was paid.

Adulterated Milk.—At Woolwich several cowkeepers and dairymen were summoned by the Woolwich Local Board of Health for selling adulterated milk. In the case of William Burcell, Mr. Wigner, the analyst, certified that the milk contained 18 per cent. of added water. Defendant pleaded that he bought the milk of a cowkeeper, and sold it in the same state. The Magistrate said he ought to have demanded a warranty, and fined him 15s. Thomas Florence, of Warwick Street, Woolwich, was alleged to have sold milk adulterated with 30 per cent. of water; he made the same defence as Burcell, and Mr. Carty, the inspector, said that defendant had been fined for the like offence 20s. in May last, and that he was doing a large trade in a poor neighbourhood. The Magistrate imposed a penalty of 40s., when the defendant said he would rather go to prison than pay. He was told to bring the money next week. Henry Peake, a cowkeeper in Chapel Street, Woolwich, was summoned for selling milk of the same quality—30 per cent. water. He had been fined £2 in March last, and the inspector stated that most of the local dealers were supplied by the defendant. Mr. Hughes, the Local Board's solicitor, suggested that the defendant was the manufacturer. Defendant said he had been away from home, and his business had been managed by his children. The magistrate fined him £5, and said that if he came to the Court again he would probably fine him £20. William Edwards, one of the retailers supplied by Peake, was fined 20s.

Selling Poisoned Sweets.—An Extraordinary Defence.—At the South Shields Police Court, on September 26th, George Wheatley, of Houghton-le-Spring, was summoned under the Sale of Food and Drugs Act, for having sold to Mr. J. J. Hindmarch, sanitary inspector for the borough, on September 13th, certain confections which were mixed with chromate of lead. The Town Clerk (Mr. J. M. Moore), who prosecuted, said the case was of some importance, inasmuch as it was a class of article sold largely to children, and at such a cheap rate that the quantity which they received for a small sum of money might do them a great deal of injury. Mr. Hindmarch was then called, and he stated that the defendant had a stall in the Market Place on Saturdays, and sold sweets. Witness purchased 6 ozs. of the confection produced from the defendant for 2d. He divided it into three equal portions, and had one of the portions analysed by Mr. Edger, the borough analyst. Mr. Edger's certificate showed that the yellow portions of the confection contained 0.68 per cent. of chromate of lead, a poisonous substance. Dr. Spear, medical officer of health for the borough, said that chromate of lead is a poisonous substance, and that the small quantity in question would contain rather more than six grains. It was a chronic poison, which accumulated in the tissues of the body, the bones, the liver, and the brain, and produced paralysis, and sometimes death. Even if the person who took it recovered, it might produce permanent injury. He believed it would be exceedingly dangerous for a child to eat a halfpennyworth of this confection daily for a few weeks. Defendant said he had just started in the business, and had had no experience of the trade. He engaged a man who had a thorough knowledge of the business, and he (defendant) expected that vegetable colours were used. He did not know how the man happened to take the wrong bottle; but he was having a cart painted just now, and the man took the wrong bottle, which was used for mixing yellow paint for the cart. The bench imposed a fine of £5, or two months' imprisonment.

Somerset House Milk Standard.—At the Thames Police Court, on Sept. 18th, Louis Roberts, a cow-keeper and dairyman, of 77, St. Leonard's Street, Bromley, was summoned by W. Harrison, one of the inspectors to the Poplar Board of Works, for selling milk from which one-half the cream had been abstracted. The purchase of the sample on the 3rd Sept. having been proved, Mr. Harrison produced the certificate of Mr. Young, the Public Analyst, which was to the effect that the sample was skimmed milk from which one-half the cream had been abstracted. The defendant was sworn and said the milk was obtained from one of his cows on that morning, and it was served to the customers just as it came from the cow. In reply to the Magistrate, the defendant said he wished to have the milk sent to Somerset House, for which purpose the case was adjoured. At the adjourned hearing, Mr. Lushington said that Mr. Young's certificate set forth that he found the milk submitted to him to be, in his opinion, skimmed milk, from which one-half of the cream had been taken. This form of certificate was, in his (the magistrate's) opinion, very unsatisfactory; he thought the analyst ought to state some facts upon which the magistrate could base his decision—if he decided the case upon a certificate such as the one before him, he really did so upon the *ipse dixit* of someone else without having anything before him upon which he could form his own judgment. On the other hand, in the certificate from Somerset House, the analyst stated that the sample of milk was deficient in fat to the extent of one-third of what was found in genuine milk, the percentage of cream or fat being 1·65. It had been found in some experiments that had been made that in some samples of milk of undoubted genuineness, that the percentage of cream or fat was as low as 1·57, or in even a less quantity than that of the milk in question. Added to this was the fact that this milk had been milked from the cow some hours before the purchase was made. Under these circumstances, therefore, he did not think he should be justified in convicting the defendant, and he should, therefore, dismiss the summons. Looking to the fact, however, that the milk was undoubtedly of a very poor character, he should order the defendant to pay the cost of the Somerset House Analysis.

The *Brewers' Guardian* says:—"The Public Analyst for Worcestershire, in his quarterly report refers to the salt in beer question, and states that he has himself brewed beers of various strengths, from 20 to 27 lbs. per barrel with distilled water and water containing a known amount of salt, and has found that the salt derived from the malt and hops amounted to from 10 to 12 grains per gallon; he, therefore, concludes that 15 grains of salt should be the outside quantity allowed for the malt and hops, which, added to that contained in the water used in the brewing, together with one-third more for increase by evaporation, would give a fair estimate of the salt naturally existing in each sample of beer. He concludes that anything over this amount must be wilfully added as an adulterant. This is hardly fair, for brewers are legally allowed to use sugar in the manufacture of beer, and very few samples of sugar are free from chloride of sodium, and, therefore, the quantity of salt in a sample of beer may be considerably above the analyst's estimate, and yet have been legitimately introduced."

NOTES OF THE MONTH.

The case reported elsewhere, in which the magistrate, acting on the sworn evidence of the defendant and a relative (coupled with his own knowledge of the chemistry of milk) dismissed the charge, is specially noteworthy from two causes. Firstly, we have the *debut* of a magistrate who has really read up the literature of the subject of milk and formed his own opinion, and who, therefore, desires figures upon which he can himself judge as to the extent of any falsification. Despite the concurrence of the Somerset House chemists in the fact of deficiency of fat in the milk in question, Mr. Lushington, acting on his own knowledge, assumed the possibility of perfectly genuine milk with only 1·51 of fat, and accordingly declined to enforce a penalty. But, secondly, we have at last what is of infinitely greater importance to analysts as a body, *a distinct standard for fat in milk laid down publicly by Somerset House*. This is really a matter so important to us all that we print in full their certificate.

Laboratory, Somerset House,
London, W.C.

The sample of milk referred to in the annexed letter, and marked No. 159, was received here on the 19th instant.

The sample was securely sealed.

We hereby certify that we have analysed the milk, and declare from the result obtained that it contains 1·65 per cent. of fat.

From a consideration of this result, we are of opinion that the milk is deficient in fat to the extent of at least one-third the quantity found in genuine milk.

As witness our hands, this twenty-sixth day of September, 1879.

(Signed) J. BELL.
R. BANNISTER.
G. LEWIN.

The Somerset House standard for fat in milk is therefore clearly 2·5 per cent., *i.e.* the figure adopted years ago by the Society of Public Analysts. This most valuable piece of information should be carefully noted by all analysts for future use, and is the more gratifying to us personally, seeing that it completely bears out the remarks we made last month as to the rapid shaking into order of the points of chemical variance, and is the first complete accordance on the part of the Government Analysts with the standards laid down by our Society. If Mr. Bell and his colleagues would only continue to give such lucid and practical certificates, all the difficulties would quickly fade away, and the absurd restrictions placed upon their action as scientific men be evaded in a very simple manner. Meantime we tender them the congratulations of their fellow workers in food analysis for their action in the present case.

In a letter to the *Glasgow Herald*, Dr. Wallace, the City Analyst, calls attention to a source of danger as follows :—

" About three months since, a serious case of illness in a child caused by eating or sucking a toy watch was reported to the Medical Officer of Health, who directed a similar one to be sent here for examination. It consisted of a green paper dial, surrounded by pink sweetmeat stuff, and the paper was found to contain about one-fifth of a grain of arsenious acid—quite enough to account for the child's illness. Happening to play recently with a pack of green-backed cards, it occurred to me that the colour was the same as that on the paper of the toy watch, and I have accordingly made an analysis with the result that each card was found to contain 1·6 grains of arsenious acid and ·91 grains of oxide of copper—or, in a whole pack, 83 grains of arsenious acid and 47 grains of oxide of copper. The green colouring matter (arsenite of copper) was entirely on the back of the cards, and by the aid of a little alkali and water was easily removed. When it is considered that the pack contains nearly one-fifth of an ounce of arsenic—more than enough to kill a hundred children—the practice of using this dangerous colour cannot be regarded with indifference. Unfortunately there is no law to prevent the use of dangerous pigments on wall papers or playing-cards, but it is well that the public should be informed of the matter so that they may be on their guard."

* * *

If we were in America we could understand an unwillingness on the part of the public to part with their "greenbacks," but here, where the colour has no such important signification, it is well that card players should take note and avoid the alluring but dangerous articles. In Germany the Adulteration Act gives power to prosecute in such a case, and we commend Dr. Wallace's letter to Dr. Carr, the great opponent of the use of arsenical colours, whose book on *Domestic Poisons* we noticed some months ago.

* * *

If the researches of Dr. Emmerich, of Munich, be relied on, all the agitation to bring water analysis within the obligatory fee of 10s. 6d., which took place lately, was thrown away; for the Professor not only declares that "the use of the most foul and putrid drinking-water produces no injurious result on the system in health; and even existing affections of the intestinal canal are not in the least aggravated by it," but that it actually cured him of a sharp attack of bowel complaint. The experiments were made not *corpore vile*, but on himself, and the water chosen was from a ditch fed, *inter alia*, by drains and privies, seasoned by the contents of dirt carts, and ornamented here and there by the bodies of departed cats. The "physical appearances" observable were fragments of fœces, dirty rags, hairs, and the general garbage of man and beast; and the odour was so well developed that it was difficult to avoid at once returning the lovely mouthful. At first the determined experimentalist experienced certain internal qualms, but after three days they vanished, and lo! he throve on his unsavoury tipple! He next gave it to a dyspeptic patient, and he decidedly improved; so after all good clean dirt for ever. Why go to the trouble to buy liver pads, or anti-fat, when we can get the real elixir of life from the nearest ditch? or rather, what a chance for an enterprising man to bottle foul water and advertise it as the genuine Munich tonic and stomachic essence, prepared after the recipe of the great doctor;—goodness knows the ingredients are both cheap and easily obtained, and the source inexhaustible!

* * *

But, joking aside, is it wise to publish such experiments to a public already too prone to sanitary neglect, and does it follow that because the experimenter escaped with his life, others would be safe to imitate him? It has been the result of our observations that it is possible to acclimatize persons to bad water just as to jungle fever, so long as no epidemic actually starts in the neighbourhood; but bring in one diseased person, and then the train is fired. It is a common remark in the country when well waters are analysed and condemned: "Oh we have drank it for years, and the analyst is talking nonsense;" but notwithstanding it is none the less the duty of all in authority to repress as far as possible the use of any water evidently subject to periodical contamination.

"*Oh Mother, look! 1s.*"—"*This is better, 1s. 2d.*," so wrote an enterprising butterman of High Street, Hoxton, taking care to well rub the first "e" in the word "better" so as to make it appear like "u." Whether mother looked is not recorded, but an Inspector did, and Mr. Bushby, in a friendly interview with our butterman, fined him £5, and added some disagreeable remarks about intention to defraud.

Still another victim to the odious analysts! A poor innocent man of Houghton-le-Spring happened to be a confectioner, who painted his cart yellow, and afterwards in his honest ignorance and praiseworthy economy, he used the same pigment for his sweets; and will it be believed that the analyst actually found ·68 per cent. of chromate of lead, and on that "miserable decimal," as one of our trade journal friends used to call it, the magistrates fined him £5.

The clause in the new Act, providing a penalty for refusing to serve in the street, has already been enforced with success. It would be well if the attention of Inspectors were more definitely called to this point, as there is no doubt much more adulteration practised in milk delivered at private houses than in that sold over the counter.

Under the heading of impure milk in Salford, we publish a full report of a series of cases in which the greatest care was taken by the inspectors to relieve the retail tradesman by tracing the adulteration to its source, but without result; the magistrate giving the farmer the benefit of the doubt, that the milk might have been tampered with after leaving his hands and before delivery at the railway station.

We publish a letter from Dr. Dupré, on the subject of the evidence lately given by certain officials connected with the Pharmaceutical Society, which is sufficiently outspoken in itself to require no comment on our part. We were, however, much struck by a passage in the evidence of Dr. Attfield, given in the soda-water case, and reported in the *Chemist and Druggist*. Asked, in cross-examination, "Are you a Public Analyst?" Dr. Attfield answered "Yes, and have been for 25 years, but not under the Act. I have always refused appointments of that kind." If this be really accurately reported, we have rarely met with a more daring instance of special pleading by a witness on oath. The term "Public Analyst" was specially created by Act of Parliament to distinguish those analysts appointed to perform the duties of that Act, and no man can call himself one merely on the strength of having practised as an analytical chemist, except by a very great perversion of the true and legal meaning of the term. We hold that in doing so a person assumes a *status* to which he has no right. It is curious that with one breath Dr. Attfield should seek to usurp our title, while with the next he should assume such an insufferable affection of superiority. He always declined appointments under the Act, says our learned friend; and it would be interesting to know how often he actually had the chance of so doing.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879. No.	Name of Patentee.	Title of Patent.	Price
719	G. A. Aitchison	Preserving Cod Liver Oil	2d.
786	J. W. Swan and B. S. Proctor	Medicinal Rhubarb	4d.
830	G. G. André	Electric Lamps	8d.
876	J. B. Spence	Electric Lighting	2d.
889	F. J. Jenssen	Manufacture of Benzaldehyd, Benzoic Anhydride, and Benzoic Acid	2d.
895	H. E. Newton	Reducing Alkaline and Earthy Sulphates and Chlorides to their Elements	
947	H. J. Haddan	Apparatus for Electric Lighting	8d.
925	K. W. Hedges	Electric Lamps	6d.
919	C. S. Gorman	Manufacture of Anhydrous Sulphuric Acid	2d.
927	R. C. Thompson	Electric Light	2d.
1045	W. Morgan and E. R. Daniel	Deoxydizing Iron	2d.
1047	J. Cawley	Manufacture of Sulphide of Zinc	2d.
1054	J. C. Martin	Manufacture of White Lead	6d.
1070	W. A. Barlow	Extracting Tannin	4d.
1081	R. V. Tuson	Disinfectants	2d.
1122	St. G. L. Fox	Electric Light	2d.
1131	T. Griffiths and J. Cawley	Manufacture of Sulphide of Zinc	6d.
1207	T. A. Dillon	Producing Electric Lights	4d.
1226	C. Rumpff	Manufacture of Azodyes from the Nitrosubstitution Products of Benzol, &c.	4d.
1510	J. Watson	Manufacture of Portland Cements	4d.
1530	J. Allmann	Oxidizing Sulphides of Sodium and Potassium in Alkaline Solutions	4d.
1410	H. F. Howell	Purifying and Deodorizing Crude Petroleum, and other Oils	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewer's Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular.

THE ANALYST.

DECEMBER, 1879.

SOCIETY OF PUBLIC ANALYSTS.

An Ordinary Meeting of this Society was held on Wednesday, the 19th November last, at Burlington House, Piccadilly. In the absence of the President, Dr. Muter, through indisposition, the chair was taken by Vice-President Dr. Dupré, F.R.S.

The minutes of the Sheffield meeting were read and confirmed.

Professor C. R. D. Tichborne, President of the Pharmaceutical Society of Ireland, and Public Analyst for the County of Longford, was proposed for election as a Member, and will be balloted for at the January Meeting.

Mr. B. Dyer and Mr. O. Hehner were appointed Auditors to examine the accounts for the current year.

Dr. Tripe read a paper "On the Discrimination of the Starches by Polarized Light," and illustrations of the methods adopted were given by means of a microscope and other apparatus kindly lent for the occasion by Messrs. Murray and Heath.

Mr. Hehner read a paper "On the Mineral Constituents of Cinnamon and Cassia."

Mr. Wigner read a paper by Mr. A. H. Allen, "On the Examination of Coffee."

Mr. Heisch read a note by Dr. Wallace "On Arsenic in Playing Cards."

Mr. Wigner read a paper "On the Determination of Carbonic Acid in Carbonates."

Messrs. Murray and Heath also sent for exhibition some Steinheils' pocket lenses, which, from their large and flat field, were much approved of.

An Extraordinary Meeting had been called at the same time and place, but Dr. Dupré postponed the resolution, which stood in his name, for twelve months.

The Annual Meeting will take place on Wednesday, January 14th, when the election of officers, &c., will take place, and among the papers to be read is one "On a Sample of Butter several hundred years old."

ON THE DISCRIMINATION OF STARCHES BY POLARIZED LIGHT.

By John W. Tripe, M.D., M.R.C.P., Edin., &c.

Read before the Society of Public Analysts, on 19th Nov., 1879.

Some time since the Inspector appointed to obtain samples under the Sale of Food and Drugs Act, brought to me several packets containing arrowroot, pea-meal, ground lentils, maizena (Indian corn flour) and ground ginger, all of which were found to be genuine. During the course of examination, I felt dissatisfied with the means ordinarily adopted, and therefore employed selenite plates with the polariscope. The plates used were red and green, and blue and yellow, when a beautiful play of colour was exhibited by the arrow-roots, and even in a more marked degree by potato starch and *tous les mois*. The colours shown by Bermuda arrowroot were not so brilliant as by those from St. Vincent and Natal. The starches of wheat, barley, oats, and rice scarcely showed any colour, and the little that was exhibited was equally diffused over the whole granule instead of being more brilliant in certain parts as obtained in the preceding class. Maizena starch presented considerably more colour than that of wheat, whilst that of lentils, peas, and beans, became less coloured than maizena, and, like wheat, did not show green colouration. The amount of colour varied considerably, according to the plate used, being usually much brighter with the green and red than with the blue and yellow, although in sago there was little or no colour with the former, whilst a band of a somewhat sober shade was visible with the latter across the narrow end, and the starch of ginger gave a slight irridescence with the red and yellow, but not with the other plate, the colour being spread over the whole surface of the starch, as in wheat, &c.

The prismatic colours of *tous les mois* and potato starch were very brilliant with the green and red plate, the green being more vivid in the potato than in the arrowroot, so that in case of doubt or when a mixed sample is examined, the comparative soberness of the colour of arrowroot will readily serve to distinguish one from another. A little care in using the analyser is necessary in order to bring this out strongly, but a comparison between the two without moving the analyser will show this most satisfactorily, the analyser being used in such a way as to give a red or green ground, the red being the best.

The starches examined evidently belonged to two groups, viz., those which showed but little colour with the selenites, and the others which exhibited brilliant and various colours. It is evident that there must be some structural difference between the two, for as a rule the starches obtained from seeds gave but little colour, whilst those obtained from tubers and rhizomes afforded much colour. Of course there are exceptions, as stated, as regards ginger, &c. The use, however, of this plan of diagnosis need not be confined to the starches, as the spiral ducts of some plants colour more than others, and the woody fibre and cells differ sufficiently in colour to assist in the discrimination of the substance examined; for instance, coffee shows numerous coloured pieces of tissue which are absent in chicory.

The best results seem to be obtained by using low objectives, half-an-inch with an A eye-piece being decidedly preferable in my opinion to higher powers, and I may mention that the solution employed was one part of glycerine and three of water. One great advantage of this method of diagnosing starches consists in the ease and rapidity with which the starches of cereals can be distinguished from those of potato and arrowroots, when compared with the ordinary methods of examination, in which considerable time is often occupied in measuring the size of the granules, or in bringing out their markings. I also find that I can see the markings much more plainly with the selenites than without them, which, however, may only arise from a peculiarity of my sight, which is not only near but weak. I have not worked out this subject by any means to my satisfaction, for want of time, and therefore hope that some one else may make a more extended investigation of the whole matter.

The members present then inspected samples through the microscope lent by Messrs. Murray & Heath.

Dr. Dupré said anything which would make the microscope work more readily would be a considerable advantage; a clumsy microscopist would not mistake wheaten starch for arrowroot, but with a middling sized potato starch it required considerable experience to distinguish it.

Mr. Wigner was convinced that all the assertions made by Dr. Tripe were correct, and it would, he thought, be a most useful process; he had not yet, however, carried it beyond the starches which Dr. Tripe had mentioned.

NOTE ON ARSENIC IN PLAYING CARDS.

By Dr. Wallace.

Read before the Society of Public Analysts, on 19th November, 1879.

In the last number of The Analyst, a letter to the *Glasgow Herald* was quoted, in which I stated that I had found a large quantity of arsenic in a pack of green-backed playing cards. I have since extended my observations, and now bring the matter before the Society of Public Analysts, in the hope that public attention may be drawn to it in such a way that legislation may follow, not only in regard to playing cards, but also to wall papers, and paper used for book covers, confectionery and other purposes. Such a law already exists in Sweden, and I have reason to know that it is very strictly enforced. The following are the results of examination of a few cards, from which it will be seen that the use of arsenical green is not confined to any particular maker:—

	As_2O_3 Grains in each Card.	As_2O_3 Grains per Pack.
De la Rue, Plain Green	1·49	77·48
Ditto, Figured	·86	44·72
Goodall, Plain Green	1·84	95·68
Ditto, Figured	·63	32·76
Ditto, ditto	·50	26·00
Willis, Plain Green	1·60	83·20
Ditto, Figured	·31	16·12
Ditto, ditto	1·45	75·40

The plain green backs, usually called club cards, contain the largest proportion of arsenic, while the figured ones have more or less according to the pattern. It is unnecessary for me to point out to the members of the Society the danger arising from the introduction of a powerful poison into an article in such general and frequent use as playing cards; it is enough to state the facts. I have only to add that, so far as I have had an opportunity of examining pattern books of various makers, arsenical-coloured cards constitute about one-sixth to one-eighth of the whole number manufactured.

Dr. Dupré said that cards were so constantly used, that he should have thought if there was really any danger there would have been many complaints of sore fingers, but he had not heard even a rumour. He, however, had had a number of lamp screens to examine, and nearly all contained arsenic.

Dr. Bartlett referred to a case he had been engaged in, where a girl had died after having been employed for a few weeks in a factory, where she had been engaged in dusting arsenical powder on paper.

With reference to the above subject, the *British Medical Journal* has the following:—

Mr. Jabez Hogg writes:—The *British Medical Journal* of the 18th Oct. directs public attention to the dangers of poisoning by the use of arsenic in playing cards. The following relates to a case of psoriasis unguium from the same cause. A lady, fond of a rubber of whist, for a considerable period suffered from a painful soreness of the tips of the fingers, extending to the roots of the nails, which became, in consequence, altered and misshapen. She had become convinced of the fact that an hour or two spent in card-playing increased the pain and tenderness; often so much so, that she was unable to deal. This went on, and in the meantime all kinds of domestic medicines were tried without effect. A medical friend, who was one of the party seated round the table, and into whose ear Mrs. W. (the lady in question) was pouring her distress, but whose eye just then caught the bright green backs of the cards as they fell on the table, half-jokingly remarked, "Arsenical cards." He said that the painful condition of his hostess' fingers was, in his opinion, due to the arsenical pigment on the backs of the cards. Mrs. W., it appeared, had a decided preference for green-backed cards. The next day, some of the pigment was scraped off a card and tested for arsenic, and an estimated quantity of arsenious acid crystals was produced. The discontinuance of the use of the cards soon led to a greatly improved state of the fingers. A pack of cards used by my children in a game of forfeits, the backs of which were of a bright green colour, on being examined, turned out to be coloured with arsenite of copper.—Dr. Wallace has sent specimens of the cards referred to in the *Journal* of October 18th to Mr. Hogg. They are London-made cards; and it is a fact that manufacturers of repute send out hundreds of similar packs of cards, the backs of which are coloured with a poisonous arsenical pigment. Between the shuffling of the cards and the warmth and moisture of the fingers, a considerable quantity of arsenite of copper will be detached and inhaled during the evening. Arsenical poisoning by coloured sweetmeats is a source of danger against which parents should be on their guard. Dr. Russell, the Medical Officer of Health of Glasgow, has furnished Mr. Hogg with the following particulars of the narrow escape of two children by sucking the coloured sugar off a toy-watch purchased at a sweet-shop. A medical practitioner reported that he had been called to see two children who seemed to be suffering from the effects of an irritant poison. On inquiry, it was found that they had quite recently eaten some sweetmeats made in the form of a watch. The parents produced one, the outer rim of which was composed of sugar coloured pink. The face was green printed paper pasted on behind, and overlapped the rim fully one-half its breadth. When this green paper was removed, a portion of the green pigment adhered to the sweetmeat; and, on submitting this to analysis, it was found to be arsenite of copper. The quantity on the entire face of the watch was estimated at eighteen grains of arsenic. Dr. Russell adds that "cases of poisoning from sugarsticks wrapped in striped green-coloured paper to attract the bairns" have also occurred. A gentleman also consulted Mr. Hogg for dimness of sight and a severe eczema of the forehead. The eczema had troubled him for several months. Since its appearance, the sight of one eye had become dim. The eruption proved very intractable; and, in one of his visits, Mr. Hogg questioned him closely about the wall-papers of his rooms; but these, he was assured, were non-arsenical. A visit to the country effected what medicine could not; it cured the eczema; but, on his return to his duty, the eruption reappeared. Three weeks ago, on entering Mr. Hogg's room, he placed his hat on the table; and, the bright maroon having at once attracted Mr. Hogg's notice, he suggested that the hat-lining was the cause of the eczema. A portion was removed and examined for arsenic, and a considerable quantity was found. The use of the hat was discontinued, and the eruption quickly disappeared. He was, however, curious about the matter, and thought he should like to be convinced of the poisonous nature of the lining. The hat was taken out; and, placing it on his head, he left home. The forehead became irritable, and on the second day the eruption reappeared. He was now thoroughly convinced. The improvement that took place when he went to the country is explained by the fact, that during his stay he almost invariably wore a wide-awake, and not the usual chimney-pot hat.

The following letter has also appeared in a Glasgow journal:—

Sir,—My attention has just been directed to a letter which appeared in a recent issue of your paper, in which Dr. Wallace sounded a note of warning against the presence of arsenic and oxide of copper in various manufactured articles, and mentions that in a single pack of cards he had discovered as much as 83 grains of the former and 47 grains of the latter poison, the pack containing nearly "one-fifth of an ounce of arsenic; more than enough to kill a hundred children." At the same time he regretted that "unfortunately there is no law to prevent the use of dangerous pigments on wall-papers or playing cards." As the "Adulteration of Food Act" legislates against the introduction of deleterious compounds into articles of food, there is certainly no reason why it should not be extended to embrace all articles of household and personal use. On the above subject it may be interesting to your readers to know what has been done in this direction in Sweden. Some years ago the attention of the Swedish authorities was seriously directed to the peculiarity of many cases of sickness, cramp, debility, depression, loss of appetite, inability to work, &c., which were quite unaccountable until clearly traced to poisoning by the presence of arsenic in paints, colours, wall-papers, ladies' dress stuffs, ribbons, carpets, curtains, blinds, pasteboard boxes, confectionery, &c. In cases of poisonous wall-decorations, the removal of patients to other chambers secured recovery, while the return to the arsenious-decorated rooms brought back the original illness. For special cases with these and other materials see "Gradualafhandling, by Dr. Adolph Grape, 1877," which can easily be procured by applying to him at "Gefle, Sweden," where he is practising. The evil influence was not confined to what is now pretty generally known as "arsenious green," but was traced in reds, browns, and yellows, in printed cloth. Nor did the use of these arsenious colours even when applied in the form of oil painting on walls, &c., prevent the generation of dangerous vapours, seriously affecting those living, and especially sleeping, near them. Some beautiful green lamp shades were found to be very dangerous, the distribution of the poison being assisted by the heat of the lamp. So painful and so numerous were the troubles arising from the presence of arsenic in various forms that the Court Chemist, Dr. Hamberg, and the (Stockholm) City Analyst, A. W. Crongvist (with whom the undersigned was engaged), investigated thousands of cases which caused prompt and rigid action to be taken. The result of the above was that, about four years ago, a stringent law was passed prohibiting the sale of any articles containing poisons, especially arsenic. This Act is so rigidly enforced that the slightest trace of arsenic leads to the confiscation of the goods and the fining of the seller. Some such law is clearly necessary to prevent the possibility of such a state of matters as Dr. Wallace has disclosed, which every respectable physician and chemist in the country can endorse and strengthen by the contribution of other instances.—I am, &c., C. O. L.

ON THE MINERAL CONSTITUENTS OF CINNAMON AND CASSIA.

By O. Hehner, F.C.S.

Read before the Society of Public Analysts, on 19th Nov., 1879.

The discrimination between ground cinnamon (*Cinnamomum Zeylanicum*) and cassia (*C. Lignea* and *C. Vera*) is a matter of some importance, but of considerable difficulty. These spices are imported into this country in very large quantities. Thus during the first forty-three weeks of this year 18,002 packages (of 56-lbs. each) of C. lignea, against 13,212 packages of cinnamon (each weighing about ¾-cwt.), and during the same period of last year, 45,433 packages of cassia and 13,489 of cinnamon were imported. The wholesale prices of cinnamon fluctuate between 6d. and 4s. 3d. per lb., whilst cassia barely reaches 6d. Considering now the extreme similarity between these barks, both botanical and structural, not a little inducement exists to substitute the cheaper for, or mix it with the more valuable spice, and it is a fact, that notwithstanding the large amount of cassia imported, it is almost impossible to obtain it under its proper name at retail establishments. I am informed that cinnamon sticks are never ground, but always sold in their whole state, only cinnamon chips and cassia being powdered. Much cassia, no doubt, is used by distillers of essential oils, manufacturers of mixed spice and of curry powder, but it cannot be doubted that much of it finds its way into the consumer's hands under a name to which it has no valid claim. However this may be, it is important to Public Analysts that they should be in possession of means to discriminate between the two kinds of bark.

The only test which, as far as I am aware, has been in use, is that founded upon the alleged difference in the behaviour of the decoctions towards iodine. Thus Flückiger and Hanbury direct in their *Pharmacographia* to "make a decoction of powdered cinnamon of known genuineness, and one of similar strength of the suspected powder. When cool and strained test a fluid ounce of each with one or two drops of tincture of iodine. A decoction of cinnamon is but little affected, but in that of cassia a deep blue-black tint is immediately produced." But, considering that both cassia and cinnamon contain much starch—as shown by the microscope—it seems *a priori* improbable that cassia starch should act normally towards iodine, whilst that of cinnamon refuses to do so. The different amount of tannin would certainly not explain the distinction as has been suggested by Pereira, as *both* cassia and cinnamon are rich in tannic acid. But the fact is that decoctions of *both* cassia and the cheaper kinds of genuine cinnamon turn blue with iodine. A few drops of iodine are first decolorized by the solutions, but a point is readily reached when the blue colour permanently makes its appearance, modified, of course, by the yellow colour of the decoction. The finest samples of cinnamon do not react much with iodine, probably because, on account of their immaturity, they contain little real starch. The iodine test is therefore of very questionable value, and genuine cinnamon might by it be condemned as adulterated. It may be admitted that in the case of cassia the reaction is obtained more readily than with cinnamon.

To find, if possible, some real difference between the two kinds of bark, I examined their mineral constituents, believing that the more woody bark, cassia, would contain a larger amount of salts of lime and magnesia than the delicate membranous cinnamon. The following analyses show, however, that this supposition was not entirely substantiated. All analyses were made upon the ash obtained at the lowest possible temperature (below visible red heat), but not recarbonated, that is to say, precisely as they would result in an ordinary analysis.

	CINNAMON.			CASSIA.	
Per lb.	1/10	3/0	3/6	Lignea.	Vera.
Coal	0·27	0·41	0·31	1·26	—
Sand	1·09	0.53	0·52	3·16	0·24
$Si\,O^2$	0·27	0·31	0·25	0·90	0·20
$C\,O^2$	29·29	32·27	32·40	27·18*	36·26
$P\,^2O^5$	3·52	2·20	3·00	3·67	1·13
SO^3	2·42	2·73	2·84	2·02	0·71
Cl	0·18	0·51	0·76	0·14	0·09
$Fe\,^2O^3$	0·78	0·41	0·46	1·23	0·14
$Mn\,^3O^4$	0·86	0·97	0·13	5·11	1·13
Ca O	40·09	36·98	40·39	25·29	52·72
Mg O	2·65	3·30	3·86	5·48	1·10
$K\,^2O$	14·22	16·70	10·35	20·58	5·60
$Na\,^2O$	3·98	2·97	4·65	3·98	0·90
	99·62	100·29	99·92	100·00	100·16
Ash	4·78	4·59	4·66	1·84	4·08

*By difference.

	WHOLE CINNAMON.					CINNAMON CHIPS,
Retail, per lb.	1/10	3/0	3/6	3/6	6/0	contg. wood, 9d. per lb.
Moisture	12·67	12·05	11·38	11·64	12·94	11·25
Ash in bark	4·78	4·59	4·66	3·44	4·28	4·44
Lime in Ash	40·09	36·98	40·39	34·32	36·99	42·11
$Mn\,^3O^4$	0·86	0·97	0.13	0·62	0·59	0·34
Soluble Ash	25·04	28·98	25·22	26·36	27·67	18·34
Insoluble Ash	74·96	71·02	74·78	73·64	72·33	81·66

	CASSIA LIGNEA.			CASSIA VERA.	
	Whole.		Ground.		
Moisture	14·22	11·88	11·05	10·37	11·36
Ash in Bark	1·84	2·54	2·55	4·08	4·85
Lime in Ash	25·29	34·49	28·63	52·72	43·40
Mn^3O^4	5.11	4·94	3·55	1·13	1·53
Soluble Ash	40·58	26·78	30·91	8·36	15·89
Insoluble	59·42	73·22	69·09	91·64	84·11

Examining these figures it appears—*First*, that the *proportion of ash* in cinnamon fluctuates between comparatively narrow limits. Cassia vera contains an amount equal to that of cinnamon, but C. lignea yields much less. *Secondly*, that the amount of *ash soluble in water* is about one quarter of cinnamon ash, less in C. vera, more in C. lignea. *Thirdly*, that cinnamon ash contains less than one per cent. of *oxide of manganese*, C. vera upwards of one per cent. C. lignea far more, up to five per cent. This is indeed the most noteworthy feature brought out by the analyses. The amount of manganese has a direct influence upon the colour of the ashes. Thus all cinnamon ashes are *white*, or nearly so, those of both descriptions of cassia *grey* or *brown*, and the latter, when heated with hydrochloric acid, yield an abundance of chlorine gas. Thus the amount of manganese serves to distinguish cinnamon from C. lignea with a high degree of probability, and even a comparatively moderate admixture of the latter would thus be rendered evident in the former. The manganese is most readily separated from the ash by means of bromine after the phosphate of iron has been precipitated by acetate of soda.

The difference between cinnamon and cassia vera is not so marked, but the low proportion of soluble ash in this will be a point worthy of notice. But C. vera is only imported to a very small extent, and it is as an adulterant or substitute, of far less importance than the cassia commonly so-called, namely C. lignea. It is, moreover, so mucilaginous that when heated with water it yields a glairy or ropy decoction.

All of the samples, the analyses of which are reported above, were of undoubted purity, and many of them were kindly furnished me by Messrs. J. Travers and Son, to whom I am much indebted. My thanks are also due to Mr. E. Riley for having assisted me in carrying out the investigation.

Dr. Dupré asked Mr. Hehner whether he had any information as to the places where the cinnamon and cassia came from. It might be that this remarkable amount of manganese was not always found; was there reason to suppose that it was really a characteristic of cassia, or that it was due to a local peculiarity of the district.

Mr. Stewart asked if Mr. Hehner had made any determinations of the quantity of iodine added in each case; it seemed to act much more rapidly with cassia than with cinnamon.

Mr. Hehner, replying to Dr. Dupré, said that he had had one of the samples of cassia lignea for two years, two other samples were quite recent, two cheap cinnamons were recent also, and they gave an ash very rich in manganese, which no doubt proved that they consisted of cassia. He had no doubt that by far the largest amount of ground cinnamon sold was really cassia. In reply to Mr. Stewart, he said cinnamon decoctions required, as a rule, a very much larger quantity of iodine. The test as given in different books was really contradictory. Flückiger and Hanbury say: first add one or two drops, and "a deep blue-black tint is immediately produced," and a few lines further on they say, "But the colour quickly disappears and becomes permanent only after much of the test has been added." No doubt there is a little more starch in cassia than in cinnamon.

ON THE DETERMINATION OF CARBONIC ACID IN CARBONATES.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 19th November, 1879.

The results obtained by the determination of carbonic acid in earthy, metallic, or other insoluble carbonates by decomposition with dilute acid in any of the ordinary forms of carbonic acid apparatus, are not of a satisfactory character. There is great difficulty in ensuring the complete decomposition of the carbonates, and almost equal difficulty in driving off the last traces of carbonic acid gas without incurring a loss of the acid used for decomposition, and thereby an apparent increase in the proportion of carbonic acid present. Even in the case of the alkaline carbonates, the results obtained in this way are less accurate than could be wished; but when carbonate of lead, or carbonate of baryta, or, still worse, mixtures of the two are treated, it will be found that the results obtained in the ordinary way will not only be somewhat irregular, but will, in most cases, show an error equal to as much as 2 or 3 per cent. of the total carbonic acid present.

In the case of white lead, where the proportion of carbonic acid present is really the standard by which to judge of its suitability for use as a paint, an error of this kind is a very serious one. The only satisfactory process by which carbonic acid can be estimated in such samples as these, is by measuring the volume of the gas evolved on treating the sample with dilute acid, and ascertaining that this gas is entirely carbonic acid.

For some years I have used a process of this kind, and after making some hundreds of determinations by it, I am convinced that, with proper care, the error in the determinations of carbonic acid need in no case exceed ·10 or ·05 of the total amount present. This greater accuracy is moreover attained without the use of any complicated apparatus, excepting a suitable gas measuring apparatus. Its attainment depends entirely on carrying out the decomposition of the carbonates in a partial vacuum, so that the liberation of the carbonic acid proceeds rapidly and freely at a temperature considerably below the ordinary boiling point of the solution. By this means the time necessary for the decomposition is greatly shortened, and the risk of the evolution of any other gases than carbonic acid is also decreased.

The apparatus required is as follows:—A test tube about 8 inches by 1, fitted with a good india-rubber cork having two holes through it; one hole is provided with a thistle funnel with stopcock, and the other hole with a glass tube of small bore also furnished with a stopcock. This test tube constitutes the decomposition apparatus; the thistle funnel is for the introduction of the acid by which the decomposition is effected, and the small tube for carrying the evolved gases into the measuring apparatus.

In addition, I use a small test tube about 1½ in. long and ¼ in. diameter to contain the sample to be analysed.

The following is the mode in which I treat the sample :—A small portion, generally in the case of white lead about 30 or 40 grains, is weighed into the small test tube; a small quantity of hot recently boiled distilled water is put into the larger test tube, and the small tube dropped into it. The quantity of water should not be more than sufficient to fill one inch of the larger tube. The decomposition tube is then securely corked, the stopcock leading to the gas apparatus closed, and the stopcock on the thistle funnel opened. The water in the decomposition tube is now rapidly and strongly boiled; the steam, which is liberated, expels all air from the tube through the thistle funnel. After the boiling has continued for a few seconds, the thistle funnel is filled with distilled water, recently boiled but cold; this will prove at once whether the whole of the air has been expelled, since in that case bubbles will no longer pass through the water in the funnel. The lamp having been removed, the stopcock on the thistle funnel is closed as rapidly as possible, and then the small amount of water which remains in it allowed to pass into the decomposition tube by cautiously opening the stopcock. By this means the air has been entirely driven out from the apparatus, which is ready for the decomposition of the carbonate in a vacuum. The delivery tube has, of course, been coupled up to the gas apparatus previously, and the stopcock in that being opened, the mercury in the measuring tube is allowed to fall, and so a vacuum prepared in the measuring tube for the reception of the gas as fast as it is liberated.

I prefer to decompose the carbonates with hot dilute nitric or hydrochloric acid; this acid should have been boiled for half-an-hour or more, to expel all traces of dissolved gases, and must then be allowed to pass in cautiously in small quantities at a time from the thistle funnel into the tube. The gas, as fast as it is evolved, will pass over into the measuring tube, and in from 1½ to 2 minutes decomposition will be completed.

The decomposition tube is then filled to within one inch of the top with hot freshly boiled distilled water, and the contents of the tube boiled in the partial vacuum which still exists. By this means the last traces of gas are driven out and collect above the surface of the liquor. This remaining space is then filled up by allowing boiling distilled water to pass in through the thistle funnel until the tube is absolutely full to the stopcock. Thus the apparatus was, when the analysis was started, devoid of air, and full only of watery vapour; and, when the analysis is complete, it contains only water and the solution of the substance also free from air.

Some little difficulty will be experienced at first in avoiding the adding of the acid too rapidly, as the carbonic acid is liberated somewhat violently in the vacuum, but beyond this there will be no practical difficulty in working the process.

As an illustration of the accuracy which may be attained with reasonable care, I may mention that 11 consecutive analyses of calc spar gave a minimum result of 43·96 per cent. and a maximum of 43·99 per cent., and that the 11 determinations were completed within 2½ hours.

In the case of white lead and carbonate of baryta, the determinations generally agree within ·03 per cent.

I need not say anything as to the measuring of the gas, since, of course, the ordinary corrections for temperature, barometric pressure, and watery vapour, must be made in every case.

FLEUSS'S SYSTEM OF DIVING AT THE ROYAL POLYTECHNIC.

THE note by Mr. Howell, the secretary to the Royal Polytechnic Institution, on the new system of diving introduced by Mr. Fleuss, has led the writer of this annotation to make a second series of observations on the process, and we are much indebted to the directors of the Institution, as well as to Mr. Fleuss himself, for the facilities they have afforded us. At our request Mr. Fleuss on Saturday last remained under the water precisely one hour, and would have remained longer on his own account but that the extreme cold of the water rendered his hands, which were not covered, incapable of ready movement. He had been a few minutes in his apparatus, and shut off from the outer air, before he made his descent. We took his pulse before he entered the water, at 6.40 P.M., found it steady and good, at 68 per minute, and his temperature natural. He descended to the bottom of the twelve-foot tank, and remained there until 7.40 P.M., when he signalled by the cord that he was about to ascend. During the time he was immersed he moved about as he liked, picked up coins, and we could see that occasionally he was sitting or partially recumbent. After he came out of the water five minutes elapsed before the helmet and ori-nasal tube could be removed, so that he was actually shut off from the external air one hour and ten minutes at least. Immediately on coming out of the water his pulse was beating at 120 per minute, but this he himself attributed, and we have no doubt correctly, to the fact that he was laden with a weight of 116 pounds (twenty in the boots and ninety-six on the shoulders) in order to keep down under the water, and that it is no easy task to carry that weight up the ladder from the tank. So soon as the helmet and dress were removed we took the pulse again, and found it beating at 90 per minute, the temperature in the mouth being down to 94° Fahr. The breathing was easy, and the face only a little pale. He said he was perfectly comfortable, but felt cold. At the end of 27 minues after Mr. Fleuss had been out of the water his pulse was at 80 per minute, and his mouth temperature at 96° F. Twenty minutes later still the pulse had come down to 68, and the temperature in the mouth had risen to 97° F. The temperature of the water in the tank was 49° at the surface, and of the surrounding air 51° F. Mr. Fleuss is an Englishman, short, slight, but well built, and full of courage and enthusiasm. He has been an officer in the Peninsular and Oriental Company's service, and has been one year making preparations for this remarkable experiment. His apparatus, which is of rough construction, was made with his own hands, and though for the present he is silent as to its mode of action, he says that nothing about it is more curious than its simplicity. It is quite certain that he has contrived to carry down with him in his diver's dress a sufficient supply of air-food for perfect breathing during very long periods of time, and it is equally clear that he has some means of retaining the expired air, for during the whole time he was in the water not a bubble of air escaped from him that we could detect. Not to be too curious, the experiment promises to be in all points of view, physiological as well as practical, of great and lasting value.—*Lancet.*

LAW REPORTS.

NORFOLK BAKING POWDER.

At the Cambridge Petty Sessions, George Warren and Henry Warren, grocers, appeared on remand to a summons obtained by the Market Committee, charged with selling the Norfolk baking powder which was, as an article of food, injurious to health. The actual defendants in the case were Messrs. Smith and Co., of Norwich, the manufacturers of the powder, who had given an undertaking to the Cambridge tradesmen to hold them harmless.

Mr. Cockerell (instructed by the Town Clerk) appeared on behalf of the market committee; Mr. Blofeld appeared for the defendants.

Mr. Cockerell, having opened the case, called the following witnesses :—

Henry Phillips deposed: I am the inspector of provisions under the Corporation. On the 21st of October I purchased four packets of Smith's baking powder. I asked for Norwich baking powder. They were each wrapped up in the paper produced. I told them it was for analysis, and I left one with them, gave one to Mr. Knights, the analyst, and kept one myself. I emptied the four into one, and divided it into three.

By Mr. Blofeld: I act under the instructions of the Town Clerk. I have not heard who has instigated the proceedings.

The Town Clerk deposed that he gave the instructions to Phillips, by direction of the market committee not——

By Mr. Blofeld: I believe I am the sole originator of the proceedings. Mr. Borwick has had nothing to do with it.

James West Knights: I am a Fellow of the Chemical Society, and am Public Analyst for the borough of Cambridge, with other authorities. On the 21st of October, I received from Phillips a parcel of baking powder for analysis. The result of my analysis was that it contained :—Ground rice, 41·5; burnt or dried alum, 15·76; bicarbonate of soda, with traces of potash silica and moisture, 42·74. Burnt alum is merely crystallised alum dried; all the water is evaporated from it. A teaspoonful of this baking powder weighs, on an average, 150 grains. If a teaspoonful were mixed with 1lb. of flour, according to the direction, it would contain about 23 grains of burnt alum, equal to about 44 grains of ordinary crystallised alum. A 4lb. loaf, so mixed, would contain about 118 grains of ordinary crystallised. The ordinary effect of alum is to whiten the bread and give it a good appearance, and makes it light. It forms phosphate, from phosphate of alumina. That is, this proportion would. Phosphate of alumina is insoluble, and destroys all the beneficial effects of bread made from flour. It makes it indigestible. Alum is a strong astringent, and is very much used in dyeing as a mordant. If phosphates are removed from food, it becomes no longer nutritive. It hardens the gluten of the bread, and renders it indigestible and liable to produce injurious results. There would be from 10 to 12 grains of phosphoric acid in a pound of pure flour. It is combined with alkalis. Mixing the spoonful of baking powder in a pound of flour would neutralise about seven grains of phosphoric acid. This is the result of a test. It would destroy it all except a mere trace. No hydrate of alumina exists as such in the powder. There [illegible]'d be a small quantity in the bread, but the main portion would be phosphate.

By Mr. Blofeld: Burnt alum is easily distinguished from crystallised alum, unless mixed with [illegible] substance containing moisture. I cannot pledge myself that I found burnt alum in this baking powder. It is impossible to say.

By Dr. Cartmell: I cannot say why I put burnt alum. It might be crystallised, but there would be twice the quantity.

By Professor Liveing: I did not make any determination as to which it was.

By Mr. Blofeld: I told Mr. Adams on the previous occasion that I thought it would weigh a less quantity. I have now tried it. I never saw a chemist use a teaspoonful.

By Mr. Deighton: There is no medical teaspoon that I know.

By Mr. Blofeld: Insoluble phosphate of alumina can be discovered in bread. It hardens the gluten. It acts in its insoluble state. It is mixed up dry. The baking powder is used in baking bread to make the dough rise, by the generation of carbonic acid. This is frequently done by joining acid with carbonate of soda. Muriatic acid is injurious to health. Hydrate of alumina is injurious. It would harden gluten. It is a necessary constituent of clay. It is generally found in bread. If corn is cleaned from clay it will contain none. It is not a constituent of the wheat. It is injurious to health. I should be very sorry to take five grains of it daily. I should be surprised to find that from 60 to 100 grains were given in 24 hours to children. I have seen some accounts of experiments in America. I don't agree with Professor Patrick in his conclusions. Alum in bread would be injurious if used in any quantities. I adhere to the opinion that the baking powder contains matter injurious to health. I still adhere to my opinion. Dr. Tidy is not the most eminent analyst. I have only used it for experiment.

By Professor Liveing: There was nothing in the powder that would destroy the injurious effect of the alum.

By Mr. Cockerell: Cream of tartar will serve the same purposes as alum, be harmless, but is more expensive. Hydrate of alumina may be good for medicine but injurious as diet.

Matthew Moncrieff Pattison Muir, Prælector of Chemistry at Caius College, deposed: I have made an analysis of the Norfolk baking powder, and agree generally with the results arrived at by the last witness. I have made several experiments with their powder. If water be added to the powder the alum is decomposed, and in baking bread or buns there is no alum. It produces hydrate of alumina, carbonic acid gas, sulphate of soda and ammonia, or potash. I tried an experiment on twelve grains of soluble alkaline phosphate, which would be present in one pound of flour. The result was almost the whole of the alumina was converted into insoluble phosphate of alumina, and thus a mere trace of hydrate of alumina was produced. I made a third experiment, mixing phosphate of soda with hydrate of alumina with water, and warmed, and a considerable amount of phosphate of alumina was produced. I made another experiment. I treated half a pound of flour free from alum with water, and found the water contained large quantities of phosphoric acid. I then mixed half a pound of the same flour with half a teaspoonful of baking powder, and treated it with water in the same way as before. The water now contained very small quantities of phosphoric acid, in the form of soluble phosphate. The insoluble portion was almost certain phosphate of alumina. I believe from these experiments that the baking powder would decompose the greater part of the soluble phosphate in the flour, converting it into insoluble phosphate of alumina, and probably very small quantities of hydrate of alumina.

By Mr. Deighton: My figures agreed with Mr. Knights as nearly as might be; there was not more than one per cent. difference between us.

By Mr. Blofeld: I have not made bread or buns or dumplings with this baking powder. I don't agree with Dr. Tidy's report. From want of medical knowledge, I won't give an opinion as to whether it would be injurious to health. I should say that a large quantity of the powder would destroy the colour of the bread.

Dr. Bushell Anningson, Medical Officer of Health for Cambridge, deposed: I have heard the evidence of the last two witnesses, and in my judgment the effect of making bread with the Norfolk baking powder in the proportion of one teaspoonful in a pound of flour would be to deprive this organism of that nutritive agent which it requires, viz., soluble phosphates. It is stated on authority that the human system requires 50 grains of phosphoric acid per day. That is expected to be derived from bread. The phosphoric acid aids digestion, and is absorbed. The effect of what Mr. Muir has described is to deprive the bread of an essential article of diet. Phosphoric acid is essential to life. Insoluble phosphate would produce indigestion.

By Mr. Blofield: I have no knowledge that baking powders containing alum have been sold for 30 years. My evidence is founded upon the chemical evidence I have heard. I have known atrophy in hospitals, through the bread used, from baking powder. I should say that bread made by baking powder is indigestible.

By Dr. Cartmell: From the chemical evidence I have heard, I think this baking powder is injurious to health.

Dr. John Buckley Bradbury deposed: I have had ten years' experience as physician of Addenbrooke's Hospital. I have heard the evidence of the previous witnesses. In my judgment the effect of making bread with the baking powder produced would be to rob the system of soluble phosphates, which are essential for nutrition. There is scarcely a third of the body when in good health that does not contain soluble phosphates. Phosphate of soda is found in the blood, and the alkalinity of the blood depends on it, and is necessary for the solubility of albumen in the blood. Anything which interferes with the circulation and respiration, probably it would lead to certain diseases of nutrition, such as consumption. Phosphorus is found in the nervous system, and the only origin of it is these phosphates. The effect of insoluble phosphates on gluten would be to harden it and render it indigestible. I should say the constant taking of food made from baking powder would be detrimental to health.

By Mr. Blofeld: I know from experience that bread made of it gave indigestion.

By Prof. Liveing: I do not think that the introduction of bicarbonate of soda neutralizes the effect of soda.

By the Mayor: After what I have heard I still think that bread made with this powder would be *injurious to health.*

This was the case for the prosecution.

Mr. Blofeld then addressed the court for the defendants, and contended, in the first place, that baking powder was not an article of food, and if it were it was not injurious to health.

He called the following evidence :—

Mr. Francis Sutton, Analytical Chemist and Public Analyst for Norfolk, Great Yarmouth, Lowestoft, and Thetford, deposed : I am the author of works on analytical subjects which circulate out of England, I have analysed the powder, and agree substantially with Mr. Knight's analysis, but not as to its being burnt alum. To mix the powder in the bread would be to mix it with the dry flour, and then to moisten it to the necessary consistency, to convert it into dough, with water. The moisture liberates carbonic acid gas from the mixture of bicarbonate of soda and alum; that gas causes the bread to rise, and the result in my opinion is that sulphate of soda, sulphate of potash, and hydrate of alumina are found. I have had a 2lb. loaf of bread made with this baking powder strictly in accordance with the directions, and I have then examined it for the quantity of alumina present, and I found it to be three grains and three-quarters of dry alumina. I have also had a loaf of bread of the same size made with yeast, from the same flour, and the quantity of dry alumina I found there was nearly three-quarters of a grain. That is contained in the flour. All the samples of flour I have ever examined did contain alumina, and I have examined many. Alumina is a white powder, which I produced, which is six grains of dry alumina hydrate. It is an earthy matter, and is in all clays a mixture of alumina and oxygen. In my opinion it is not injurious to health. Dr. Pereira recommends it in large quantities for acidity of the stomach. My experience would support Professor Patrick's experiments, that it has no effect whatever on the human system. I have had practical experience of its use for Norfolk dumplings in my own family for some years without the slightest prejudicial effect. It makes light bread. I do not agree that it hardens the gluten and makes it indigestible; I speak from personal experience. Before this case was stirred at Cambridge I never heard any complaint of it. Mr. Muir's experiment was a laboratory experiment. Mr. Muir first separates the soluble phosphates from the flour by water, and then adds either alum or hydrate of alumina or baking powder to them, and so he gets phosphate of alumina. That I should expect he would, but it does not prove that the addition of the baking powder to dough was the same thing, and I do not believe it does become phosphate of alumina in the case of bread. The phosphate would be perfectly inert and harmless to health. It makes no difference whether it is phosphate of alumina hydrate. Excess of baking powder would discolour the bread. My opinion is that bicarbonate of soda neutralises muriatic acid and sulphuric acid. Tartaric acid is sometimes used, but not with such good effect as alum.

By Mr. Cockerell : Alum is cheaper. I have made laboratory experiments. This baking powder does not harden the gluten.

Dr. Michael Beverley, of Norwich, Assistant Surgeon to the Norfolk and Norwich Hospital, and House surgeon for seven years : Taking the evidence I have heard, I am of opinion that there is nothing in the baking powder, used as directed, injurious for food. I have used this bread myself, and have heard no complaint of it before this Cambridge matter arose. Alumina is contained in fuller's earth. Bicarbonate of soda renders alum perfectly inert. I took 20 grains of alumina to see if it had any effect, and it had none whatever, and I am prepared to take the same quantity again.

By Mr. Cockerell : I have not taken that quantity day by day. I believe phosphate of alumina is more injurious than hydrate. I agree that alum is a bad thing in bread.

Mr. Joseph Becarle Smith said : I am the senior partner of the firm who manufacture this baking powder. I was recently Mayor of Norwich, and am now deputy-mayor. I am a wholesale druggist. The manufacture of this baking powder has been carried on for over twenty years. I have carried it on for the last seven years or longer. We send several tons of it from Norwich every week over a great part of the United Kingdom, and a considerable quantity comes to Cambridge. Recently my trade with Cambridge has very much increased. I have never in my life heard anything about this baking powder being injurious before this matter arose at Cambridge.

This concluded the evidence, and the Magistrates retired to consider their decision. After having well considered the case, they returned into court and inflicted a penalty of 40s. and costs. Notice of appeal was given.

Heavy Fines for Adulterated Milk.—At the Bristol Council House, Charles Payne, of Downend, was summoned by Mark Hookings, of Berkeley Place, and also by James Baker, of Wilson Place, for selling to them forty quarts of milk, which was not milk but a mixed fluid not of the quality demanded. Mr. Wansbrough prosecuted, and explained that the complainants were dairymen in Clifton, who had entered into an engagement with the defendant to supply them with milk. The milk had been analysed by Mr. Stoddart, and certified by him to be "deficient in all component parts to the extent of 15 per cent. of the usual average." The article to be supplied to the complainants was "genuine new milk" at 10d. and 11d. per gallon. The complainants were called, and Mr. Yeates, Inspector under the Act, gave evidence, stating that some of Mr. Baker's milk contained 30 per cent. of water. The defendant denied having added water to the milk, and said that he could not be responsible for everything that was done on the farm. The wet weather had much to do with the poorness of the milk. The Bench considered the case a bad one and fined Payne altogether £20 and costs, or in default of payment two months' imprisonment.

Costly Adulteration.—At the Nisi Prius Court the case of Hayes *v.* Payne was heard. Mr. Cole, in stating the plaintiff's case, said, though simple in its facts and nature, it was a very serious matter indeed to the plaintiff, Mr. Hayes, who was a dairyman and milk retailer, 7, Victoria Street, Clifton. He had carried on business there for forty years, and that he carried on a very extensive trade would be gathered from the fact that he paid upwards of £1,000 a year for milk, and he also sold butter and other goods in which dairymen dealt. The defendant was a farmer, and carried on business at Downend, and the consequences of the breach of contract which plaintiff charged defendant with had been very serious indeed, because the Inspector of the Sanitary Authority stopped one of the plaintiff's milk boys in the street, took a sample of milk, which he submitted to the County Analyst, and it was found to contain nearly one-fourth of water. The result was that the plaintiff was summoned before the magistrates and fined £1 and costs. The mere fine was, of course, not a matter of much significance to the plaintiff, but the case was published in every newspaper in Bristol, and was, of course, read by those who were in the habit of dealing with the plaintiff, the result being a most serious injury to his business, and the loss of a great number of his best customers. On the 24th of March, 1878, the plaintiff entered into a contract with the defendant to supply him with milk of the best quality, at 11d. per gallon, up to the 29th of September, and after that date he was to pay a shilling per gallon. Prior to the 27th of September several complaints were made to plaintiff of the quality of the milk, and he complained to the defendant. Mr. Payne replied that it was no fault of his if it was not pure, and in order to secure its not being tampered with, the defendant supplied a padlock to the canister in which the milk was brought into the city, keeping a key himself and sending a duplicate key to the plaintiff. On the 27th of September the milk was received as usual, and put into the cans for the plaintiff's boys to carry out, and it was in no way meddled with. On that day, as a boy was delivering milk, he was met by Mr. Yeates, the Inspector, who bought half a pint of milk, telling him that he purchased it for the purpose of analysis. When the boy got home he communicated to the plaintiff what had occurred, but his milk was then all gone, and it was impossible for him to take a sample of the milk. On the 29th of the same month the plaintiff thought it right to ascertain whether the milk was being supplied in a proper state or not, and though at that time he had not been summoned, he took samples of the milk which came from defendant. In the presence of his man who brought it he unlocked the canister and poured the milk into the cans, and from them he filled three bottles, giving one to defendant's man to take back to defendant, another he took to Mr. Stoddart, the City Analyst, and the third bottle he kept. On the 15th November and the 4th of December he took two further samples, and in consequence of its quality on the latter date he declined to take any more from defendant. The result of the analysis of the milk which the plaintiff sent to Mr. Stoddart was that it contained 25 per cent. more water than there ought to have been. Evidence was adduced in support of this statement, when Mr. Bompas addressed the jury for the defendant, and remarked that though the actual money at stake was small, the action was one of considerable importance to the parties concerned. After the evidence which had been given by Mr. Stoddart, he should not contend that the milk which he analysed was pure milk, for it was evident from the result of his examination that the milk which he submitted to analysis was not pure, genuine milk, which the defendant contracted to serve to the plaintiff, and which he would prove was supplied. The defendant was a man keeping a very large dairy, having from 60 to 100 cows, some of them of the Guernsey and Jersey breed, and some of them half-bred, the milk obtained from them differing in richness and in the proportion of cream, but altogether giving fair average milk. The learned counsel detailed the process carried on in the defendant's dairy, pointing out that the milk obtained from all the cows was mixed and fairly distributed amongst the whole of his customers. He supplied several large institutions, and he should call witnesses from those places to prove that the milk supplied them by the defendant at the time at which the plaintiff complained was perfectly good and pure. The learned counsel contended that it was not for him to show where the adulteration took place, his only object was to prove to them that it had not been the act of the defendant. He thought that it was not an uncommon thing for milk to be adulterated with water, and that it was no slander to say that milkmen eked out their quantity in that manner. He remembered upon one occasion requesting his milkman to supply the milk and the water separately, and he said it could not be done. After hearing evidence in support of the defence, the Lord Chief Justice fined the defendant £10 and costs, the latter we are informed exceeding £300.

Prosecutions by the Dairymen's Society.—At Clerkenwell Police Court, J. Watson, of the Farmers' Dairy Company, Holloway, was summoned for selling a pint of milk to Mr. Parish, Inspector of the Metropolitan Dairymen's Society, adulterated with 18 per cent. of added water. Mr. Ricketts, who appeared on behalf of the Society, said the defendant was in a large way of business, and called Mr. Parish, who said that he purchased a pint of milk of W. Blackwell, servant to the Dairy Company, which was divided in the street into three parts, one being handed to the vendor for his master, and one to Dr. Tidy, the analyst, whose certificate stated that it was adulterated to the extent of 18 per cent. The defendant's counsel said that his client took every precaution to ensure the purity of the milk, but he had so many different suppliers, and thirty men in his employment as carriers. W. Blackwell, who sold the milk, said that the sample which was given to him by the Inspector was accidentally broken, and he did not let his employers know that a sample had been taken. It was urged for the defence that in consequence the defendant was quite ignorant of the matter till he received the summons. The Magistrate said he considered it a very bad case; the defendant being in a large way of business he should fine him £10 and 2s. costs. Mr. Ricketts asked the Magistrate to allow the Society its costs, as it did not get the fine, whereupon his Worship altered his decision, and fined the defendant £5, and £3 5s. costs. At Lambeth Police Court, A. Herring, dairyman, Newington Butts, appeared to a summons taken out by Mr. Parish, for selling adulterated milk. Mr. Ricketts appeared to prosecute on behalf of the Society, and in opening the case stated that the Society prosecuted on public grounds. They were no respecters of persons, and any milkseller who was suspected of adulteration would be visited by their inspector. This was a very bad case, and he intended asking for a full penalty. Mr. Parish proved purchasing a pint of milk at the defendant's shop. He was served by a young woman in the service of defendant, and told her after the purchase that it was intended to have the milk analysed. She then told him that it was not pure milk. In answer to the complaint, the defendant said on the day in question he could not get the quantity of milk he required, and therefore had to add some water. Mr. Saunders said the defendant then admitted adding water to the extent of some 25 per cent., for that was the adulteration according to the certificate produced before him. It was a most shameful case, and he ordered the defendant to pay a fine of £5, and £1 3s. costs.

Adulteration of Flour.—Colonel Shortt, the Inspector for North Derbyshire, under the Sale of Food Act, summoned Edmund Hodgkinson, of Baslow, miller, for selling a packet of flour adulterated with alum to the extent of 150 grains to 4 lbs. of flour. Mr. Hughes, of the firm of Young and Co., of Sheffield, appeared for the defendant. The defendant appeared to have allowed the Inspector to choose samples where he liked in the mill, and three were taken and paid for and divided in the usual way for analysis. Two of the samples were pure, but one was said to be adulterated as charged. This sample was marked "Flour-fourths," and it was contended that it was not used for the food of man, and the defendant said that it was taken from an open bag, from which his men fetched it to feed the pigs. He did not know how the alum had got into it. Mr. George Wallwinn, Mr. J. B. Bowman, and Mr. John Evans, millers in the neighbourhood, were called for the defence, and each of them stated that flour-fourths or "fine sharps" were not used for the food of man, neither was it the practice to mix alum with it, as it would spoil the flour. Case dismissed.

Country Milk.—At Clerkenwell Police Court, on the 23rd ult., Isaac Price, of 7, Great Sutton Street, Clerkenwell, was summoned by Sanitary Inspector Cheshire, Clerkenwell, for selling milk adulterated to the extent of 20 per cent. with added water. Mr. Bolton, solicitor for the parish, said he did not ask for a large penalty. Mr. Ricketts, for the defence, urged that the defendant was a poor man, and "sold the milk as country milk." He had no idea of cheating his customers. The Magistrate ordered the defendant to pay a fine of 10s. and 2s. costs.

Refusing to Serve an Inspector. At Southampton, on the 21st ult., a milk vendor named Silas Rawlins, living at Millbrook, who has several times been heavily fined for selling adulterated milk, was fined £10 and costs, by the borough magistrates, for refusing to supply milk to the Inspector for the purposes of analysis, under section 4 of the Amended Food and Drugs Act. The proceedings were instituted by the Corporation, who have obtained a large number of convictions on similar informations within the past fortnight.

Another Refusal to Serve.—At Lambeth, Mr. Marsden, the vestry clerk of St. Giles's, Camberwell, appeared in support of several summonses taken out, under the New Adulteration Act, in reference to the supply of milk. Some important questions were raised in the investigation. The Sanitary Inspector was refused by the servant of one of the defendants who was serving milk at houses, and, on being asked for a quantity by the officer, declared that he had none to spare, and that all he had was required for the customers. Mr. Marsden said if such an excuse were allowed the new Act would be defeated. Mr. Chance thought it must be shown that a man had milk to sell, and those customers who had ordered certain quantities were not to go without their breakfast because an inspector wanted a certain quantity for the purpose of analysis. Mr. Marsden thought that the men should be supplied with a quantity beyond the quantity ordered. The new provision was framed at the instance of the Local Government Board to meet the defect in the former Act as to milk sold in the streets. If the view taken by the magistrate prevailed, the new Act could be easily defeated, and the best way would be to take a special case to the superior Court. Mr. Chance asked why the milk could not be obtained at the shops. Mr. Marsden said because shops now supplied good milk, and milk-and-water was sent out to the customers, and if the excuse "None to spare" were allowed the new statute would be entirely defeated. Mr. Chance said it was certainly a most important question, but he did not see how, when a certain quantity was ordered, a man was bound to supply an inspector. The case was worthy of consideration, and a special case for the superior Court might be granted.

Selling Impoverished Milk.—Sarah France, Oldfield Square, Lockwood, was charged with selling milk not of the nature or quality demanded. Mr. Kirk, the sanitary inspector, said the defendant was a milk dealer, and that on the 15th October he saw her son delivering milk, and went and asked him whether he would let him have a pint. He replied "Yes." When he had got the milk he told him who he was, and that the milk was intended for analysis, and asked him if he would retain a portion. He said he would, and he (Mr. Kirk) divided it into three portions—one he retained, one he gave to defendant's son, and the other he submitted to Mr. Jarmain, the Public Analyst. When defendant's son supplied him, he (Mr. Kirk) said, "I suppose you sell this as new milk?" He replied, "Yes; just as we get it from Thomas Shepherd, of Holmfirth." Mr. Jarmain's certificate was put in, and showed that the milk had been deprived of 25 per cent. of butter fat. He (Mr. Kirk) had since got a sample of milk from the wholesale dealer (Mr. Shepherd) and found it corresponded in quality to that obtained from the defendant, but Mr. Shepherd told him that the milk supplied to defendant was not new, but skimmed. Thomas Shepherd, farmer and milk dealer, Bottoms, Holmfirth, said he was in the habit of supplying the defendant with milk. He supplied her on the 15th Oct. with the usual quality—"night's" and "morning's," which meant the night's milk skimmed, mixed with the morning's new milk. Mr. Kirk: Is the defendant aware of that fact? Witness: For anything I know. Mr. Jarmain was called, and the Bench asked him whether mixing skimmed with new milk would make 25 per cent. difference? Mr. Jarmain said that milk varied very much in the amount of butter fat it contained. The Public Analysts had fixed a certain standard limit, and when milk is below this they think it has been tampered with. They took a very lenient view and allowed a liberal margin, but a deficiency of 25 per cent. of butter fat was much below the limit. Mixing night's skimmed milk with morning's new would make at least 25 per cent. difference in the quality. The Bench considered the charge proved and imposed a penalty of 20s. and costs, altogether £2 5s. 6d. William Fearnley, milk dealer and farmer, Honley, appeared to answer two charges of a like nature, and he pleaded guilty to both. Mr. Kirk said the defendant was in the habit of delivering milk from house to house. Whilst so engaged at Taylor Hill on the 15th October, he sent a person to purchase some, and he was refused. He then went himself to defendant and said, "Won't you let me have any then?" He replied, "Oh, it's you, is it? Yes, I'll let you have some, but it's old." He asked the defendant what he had been selling in the house. He replied, "Old of course." He (Mr. Kirk) obtained a pint of milk and paid defendant a penny for it, told him it was for analysis and gave him a third part of it. Mr. Jarmain's certificate of analysis showed it to be deficient of 45 per cent. of butter fat. Mr. Kirk said that although the defendant sold the milk to him as old, there was no doubt he did so to escape the consequences, and that he had been selling it as new milk to his customers. Mr. Jarmain said old milk showed 1 per cent. of cream, but the sample in question showed 4 per cent. of cream and 6 per cent. butter fat, whereas old milk never contained more than 1 per cent. The sample submitted was, in his opinion, a mixture of night's and morning's milk. New milk showed 8 per cent. of cream. Mr. Kirk said that five minutes after taking the above sample he proceeded to a house, and a person consented to get another sample from the defendant. When he came round this person bought a pint of milk, for which defendant charged 2d. He (Mr. Kirk) stepped forward and paid for it, and told him again it was for analysis, and said, "What kind of milk do you call this?" Defendant said, "Oh, this is different; this is a mixture of night's and morning's." He (Mr. Kirk) then said, "How is it that you said before you had nothing but one sort?" Defendant seemed quite "flabbergasted," and could not answer. Mr. Jarmain's certificate showed that the milk had been impoverished by the removal of 28 per cent. of butter fat. Defendant said he had told his customers time after time what it was, that it was not new milk. He got it from the farmers, and sold it just as he got it, and Mr. Kirk ought to prosecute the farmers, not him. Mr. Kirk said defendant's object had been to evade the Act, and he asked the Bench to impose a heavy penalty. The Bench said they considered it a very bad case indeed, and imposed a penalty of £5 and costs in each case, altogether £13 13s., or in default, three months' imprisonment in each case. The defendant, who seemed struck dumb, said, after a long pause, "I think it's too much."

SPURIOUS TEA.—"At the tea sales this week some re-dried teas, which had been submerged in the Thames, found buyers at 3¾d. to 10d. per lb. for the capers, and 11d. to 1s. for the orange pekoes." Selling tea of this sort, besides giving an erroneous idea of the value of genuine teas bearing the above names, is committing a great wrong on consumers, who, caught by the apparent cheapness of the specious article, are deceived into buying what is mere rubbish and unfit for food. We also briefly allude to some other parcels that were offered on Thursday, the 6th inst., as "gunpowder," but no more resembled that choice description than painted flowers, being nought else but coarse sloe-leaves and dust thickly coated with mineral facing. The day of the month inclines us to think that there was more "treason" than "gunpowder," and very little indeed of the latter compound in the teas and those who offered them. The teas were imported as far back as 1872, and sold at 6d. to 9½d. in bond. Will the proper "authorities" interfere and stop this spurious tea from paying duty, and so passing into consumption?—*Grocer.*

A DEEP ARTESIAN WELL.—The sinking of the deep artesian well near Buda Pesth is now completed; the works were commenced as far back as 1868, and during their progress many interesting facts relating to geology and underground temperature have been brought to light. The total depth is 3,200 feet, and the temperature of the water it yields is nearly 165° F. The temperature of the mud brought up by the borer was taken every day, and was found to increase rapidly, in spite of the loss of heat during its ascent, down to a depth of 2,300 to 2,700 feet. Beyond this point the increase was not so marked. At a depth of 3,000 feet the temperature was 177° F., giving an average increase of 1° for every 23 feet bored. Water first commenced to well up at a depth of 3,070 feet; here its temperature was 110° F., and from this point onward it rapidly increased both in quantity and temperature. Thus, at 3,092 feet, its temperature had already risen to 150° F., and the yield in twenty-four hours from 9,500 to 44,000 gallons. Finally, when the boring had reached 3,200 feet, at which point it was stopped, the temperature of the water, as it burst from the orifice of the tube, was 165° F., and the volumetric yield 272,000 gallons in the twenty-four hours. This yield was afterwards reduced to 167,200 gallons, in consequence of the bore being lined with wooden tubes, which reduced its diameter. The water obtained disengages carbonic acid in abundance, and also contains nitrogen and a little sulphuretted hydrogen, and 80 grains per gallon of fixed matters, chiefly sulphates and carbonates of potash, soda, lime, and magnesia.—*Brewers' Guardian.*

NOTES OF THE MONTH.

It is curious that *The Grocer* should enquire "Where are the analysts?" but still more so that it should be because some one has sold rotten beef. However, when we read a little further, we find that it is a co-operative society who is in fault, so there is no wonder. The *Grocer's* antipathy to co-operative societies must certainly be expected to override its natural aversion to analysts.

We are not at all surprised that some of our contemporaries want to know how it is that, since the Somerset House Chemists now agree to the milk standard of the Public Analysts, there should have been any differences in time past. This, however, is easy to explain. Experience is not gained in a day, and the Inland Revenue officials (of course we do not speak of Mr. Bell and his colleagues, but only of the gaugers and other similar officials employed to collect the samples of milk) have now gained the necessary experience, and find that the figures we laid down years ago are correct. Such an accordance implies no discredit to the Somerset House chemists, but, on the contrary, simply shows that as they obtain new light on the matters in question they act as scientific men should, and alter their opinions accordingly.

Mr. Chance, the worthy magistrate of Lambeth, in his wisdom, thinks that a milkman delivering milk at houses must be proved to have milk to sell before he can be summoned for refusing to serve an Inspector, and that customers who have ordered certain quantities are not to go without their breakfast merely because an Inspector wants some milk for analysis. We are extremely sorry to find a metropolitan magistrate holding such an absurd opinion as this. Even if milkmen have not always far more than enough to serve their regular customers with, yet surely such customers deserve to be as much protected from fraud as people who obtain milk from shops. But if such a decision as this is to stand, a milk-round, at least in Mr. Chance's district, will be about the most profitable concern going, as the dealers prohibited from watering the milk sold in their shops will take good care to well water that to be delivered at houses, and with the excuse Mr. Chance has put into their mouths, "None to spare," they may go on their round rejoicing, and bid defiance to the Inspector. We presume the Lambeth magistrate actually has seen the Act passed last session to enable Inspectors to purchase samples from street vendors. We are happy to see that other magistrates hold a more sensible view, and consider that if a milkman has a can from which he is serving customers at houses with one, two, or three-pennyworth, according to the quantity required, he is actually selling milk. If some of his customers require more than usual, he don't say to them, "None to spare," because he is prepared for it; and he is equally prepared with enough extra milk to serve an Inspector with a pint. If he refuses he does so because he knows he will be summoned for adding water, and not for the reason Mr. Chance gives.

We notice that a Bristol farmer has lately been fined £20 and costs for sending out to his customers milk containing 15 per cent. of water; and in another case—an action against him by a dairyman for supplying milk containing 25 per cent. of water—he has been condemned to pay a fine of £10 and the costs, which are said to amount to over £300. We should imagine that this farmer, with a dairy of a hundred cows, will, in future, send out their produce only to his customers, and not indulge in the expensive habit of mixing with it the produce of the cow with an iron tail. With these costly proceedings in the mind of the Bristol farmers, the milk dealers there will, we hope, get the purest milk supply in the kingdom; but we rather wonder whether it will be in the same pure condition when it reaches the consumers.

Sunday adulteration may fairly be commended to the notice of inspectors. We used to have milk and water on Sunday morning, but as we did not agree to the maxim of "the better the day the better the deed," a vigorous remonstrance and a private milk-can put a stop to the swindle. The inspectors had better look out a little sharper, perhaps some other things besides milk may be reserved for Sunday morning, or at any rate Saturday night might be possible. We have to thank a trade contemporary for this hint.

It might be only fair to give the traders a hint in return. If it should happen that a manufacturer receives a letter threatening him with exposure because, as it is alleged, his manufactures contain poisonous metals, his proper and straightforward course is at once to submit samples to the Public Analyst of the district in which his works or warehouse is. The cost of such a course will be, comparatively speaking, trivial; while the cost of black mail can never be foretold.

Manufacturers should bear in mind that no proceedings can possibly be instituted on the certificate of any person other than a Public Analyst, and that Public Analysts are the only legally appointed officers to whom cases of supposed adulteration can be sent.

The term Public Analysts is a legal title; but, if some recent proceedings are continued, it will certainly become necessary to impose by law a penalty on those using it illegally. Public Analysts are amenable to the veto of the Local Government Board on their appointments, and it is quite right that they should be so; but for that very reason, those who pretend to act as Public Analysts without authority must be made subject to penalty.

It would be very interesting if some of the millers would tell us if alum is ordinarily mixed with pig food. Of course Public Analysts have no concern with the matter directly, but when samples of "flour fourths" are said to be intended for the food of pigs, and not men, the question naturally arises, "In what way can the alum do good to the pigs?" We do not recollect that we have ever heard that swine showed any preference for bread artificially whitened.

The papers for this month contain reports of a number of cases of proved adulteration, in which the summonses have been dismissed merely because the vendors have declared the admixture after the inspector had said that he purchased for analysis. An important case has, however, just been decided on appeal before Justices Lush and Manisty, which we trust will put an end to this. We must postpone until next month a full report of the case; but, shortly, the judges affirmed the conviction of a vendor who had been asked for coffee and received the price of coffee, and supplied instead a mixture of chicory and coffee, although he had, after being informed that the sample was required for analysis, called the purchaser's attention to a label declaring it to be a mixture.

We have not space to do more than call the attention of our readers to the full report on another page of the decision at Cambridge with respect to Norfolk Baking Powder.

ANALYSTS' REPORTS.

The quarterly report of Mr. W. W. Stoddart, Analyst for the City of Bristol, states that he has examined sixty-four samples of food, &c. Three of the samples were of so bad a quality that adulteration was suspected. One sample of butter submitted by a private individual was genuine, but of bad quality and with a rancid smell. Five other samples were good. A sample of tea submitted by a private individual was good.

Mr. W. F. Lowe, Analyst for Flintshire, reports that during the last quarter he examined 21 samples of which 7 samples were adulterated, viz.:—5 out of 9 samples of spirits, and 2 out of 6 samples of milk—a large percentage, which shows that Mr. Lowe's recent appointment as analyst was made none too soon. We hope that his next report will show both an increase in the number of samples examined and a decrease in the percentage of adulteration.

Mr. West Knights, Public Analyst for Cambridge, in his report for the quarter ending September 30th, stated that twelve samples of food and drugs had been submitted to him for analysis, four of which he found to be adulterated. Out of four samples of buns three were genuine, and one was adulterated with alum in the proportion of 182 grains of alum per four pounds. The vendor, on being summoned, proved the use of a certain baking powder (which was found to contain 15 per cent. of burnt or dried alum) and was fined 1s. and costs. Out of four samples of baking powder, two, of the same make as the above, were adulterated with 15 per cent. of alum. Three samples of drugs, viz., spirit of nitrous æther, grey powder, and blue pill were found to be genuine. One sample of milk, submitted by a private purchaser, was found to be skimmed milk, diluted with 18 per cent. of water. No proceedings were taken against the vendor.

ADULTERATED HOPS.—The *Transactions of the Medical Society of Upsala* contain an account of an ingenious fraud in the hop trade, said to be practised on a considerable scale in that city. Hops which have already been used for making extracts, or for brewing in the ordinary way, are damped with a tincture of absinthe or wormwood, freed from spirit by distillation, re-dried, and then placed in the market as a genuine article with or without much bloom. Owing to their increased bitterness they often command a better price than unadulterated hops.

ANSWERS TO CORRESPONDENTS.—T. Woods.—You will find a note "On the Determination of Alcohol in Ether and Chloroform," by Mr. Allen, in THE ANALYST, Vol. II., p. 97.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879. No.	Name of Patentee.	Title of Patent.	Price
967	R. Weare	Manufacture of Charcoals	2d.
1012	A. L. Coke	Electric Lighting	2d.
1266	J. H. Johnson	Manufacture of Saccharate of Lime	4d.
1306	J. Allmann	Separating Sulphur from Alkaline Solutions	2d.
1313	S. G. Thomas	Manufacture of Bessemer Steel from Phosphoretic Pig Iron	4d.
1359	H. E. Newton	Manufacture of Sulpho Cyanides and Ferro Cyanides	6d.
1387	A. W. Lake	Dynamo and Magneto Electric Machines	4d.
1410	H. J. Haddan	Purifying Gas	4d.
1444	W. L. Wise	Producing Preparations of Alumina	4d.
1484	M. Gill	Evaporating Saccharine and other Liquids	6d.
1509	J. H. Johnson	Manufacture of Aluminium	4d.
1577	F. T. Reade	Eliminating Phosphorus from Phosphoretic Pig Iron	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American *Traveller*.

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The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

A MONTHLY JOURNAL FOR THE INFORMATION OF THOSE INTERESTED
IN THE PURITY OF FOOD AND DRUGS, AND IN GENERAL
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THE ANALYST.

JANUARY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

The Annual Meeting will be held at Burlington House, on Wednesday, the 14th inst. The Annual Dinner will take place the same Evening. Particulars will be sent to Members as usual.

NOTE ON THE EXAMINATION OF COFFEE.

By Alfred H. Allen.

Read before the Society of Public Analysts, on 19th November, 1879.

In a series of articles on "Chemistry applied to the Detection of Adulteration," published during 1874 and 1875, I described three methods as likely to be of service for the approximate determination of chicory in samples of mixed coffee.[*] Since the date of their publication I have acquired a large amount of additional experience in their use, and have arrived at the following conclusions.

In brief, the three methods suggested as applicable for the determination of chicory in coffee were as follows:—

I. Determination of the soluble ash.

II. Comparison of the tint of an aqueous solution of the sample with that furnished by similarly treating a standard specimen.

III. Determination of the density of a 10 per cent. infusion in hot water.

With respect to Method I., which in the paper referred to was merely suggested as of possible value, experience has shown that it is only capable of furnishing results of the roughest possible kind. This fact is due to the variations in the percentage composition of the ash of both coffee and chicory, as well as to differences in its total amount. In twenty samples of roasted genuine coffee recently examined, the total ash varied from 3·78 to 4·87 per cent. This last result was very exceptional, the next highest being only 4·39 per cent., while the average of the whole twenty samples was 4·04 per cent.[†] The soluble ash varied in thirteen samples from 2·52 to 3·50 per cent., the average being 2·97 per cent. If the total ash be taken as 100, the highest proportion of soluble ash met with was 84 per cent., with the exception of the sample yielding 86 per cent., referred to in the above-mentioned paper. The lowest percentage of soluble matter found was 60 per cent. of the weight of the ash, while the average is 73·5 per cent.

These differences are in themselves sufficiently great, but they are exceeded by those exhibited by chicory, owing to the considerable and very variable proportion of silica present in the latter substance. The proportion of actual sand in commercial chicory varies from a trace, up to 4·5 per cent., a difference quite sufficient to invalidate deductions made from the proportion of soluble ash. By deducting the sand from the total ash, and considering the number thus obtained to be the true ash of the sample, more concordant results are obtainable, but the variations are still too large to allow of the method being employed for any purpose beyond a check on the proportion of chicory in a mixture.

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[*] *Chemical News*, XXIX., 140.

[†] The total ash of coffee has been determined by Dragendorff, who found a minimum amount of 3·83 per cent. and a maximum of 4·87. The average ash of the twenty-five samples examined was 4·41. Why there should be so wide a difference between Dragendorff's and my own results I am unable to conjecture. I have no reason to suppose that partial volatilization has occurred.

Method II., depending on the colour of the infusion, is capable of giving rapid and fairly reliable estimations of the proportions of chicory present in mixed samples, but in practice it is open to the very serious objection that a standard mixture of various coffees and chicories is apt to undergo a change which gravely affects the colour of the infusion. By comparing the infusion of the sample with a permanent coloured solution, such as can be prepared by mixing the sulphates of iron, cobalt, and copper in suitable proportions, the above-named annoyance and source of error may be wholly avoided, and the method again becomes very valuable. I am unable to perceive any advantage in the method of working suggested by Dr. Leebody* over that originally described by me.

Method III., which is based on the difference in the density of similarly prepared decoctions of coffee and chicory, is one which further experience has proved to be very valuable. The weak point in the method as originally suggested by Graham, Hofmann, and Campbell was that these chemists prepared their solution by treating a known weight of the sample with ten times the quantity of cold water, and then gradually raised the liquid to the boiling point. By operating in this manner there is no certainty that the sample will be completely exhausted, and hence accurate comparison of different samples is difficult or uncertain. As a matter of fact, I have reason to think that exhaustion of the sample is *usually* tolerably perfect, but it is evidently preferable to boil well, filter, and wash the residue with hot water till the filtrate measures 10 c.c. for every 1 gramme of the sample operated on.

By operating in the old manner, Graham, Hofmann, and Campbell obtained, from roasted coffee, 10 per cent. decoctions which varied in density (at 60° F.) from 1008·0 to 1009·05, the average of the eight samples being 1008·7, a result identical with the mean of those obtained by me in 1874.

By the exhaustion modification of the process, I have recently obtained the following results from genuine roasted coffee.

Description of Coffee.	Density of Decoction.
1. Plantation	1008·4
2. ,,	1008·0
3. Fine Plantation	1007·1
4. ,,	1008·4
5. Ceylon	1008·0
6. Costa Rica	1008·1
7. East India	1008·7
8. Unknown origin	1007·1
9. ,,	1007·4
10. ,,	1008·2
11. ,,	1008·0
12. ,,	1006·8
13. ,,	1008·5
14. ,,	1007·8
	Mean 1007·9†

---

* *Chemical News*, XXX., p. 243.

† It will be observed that Graham, Hofmann and Campbell's method gives slightly higher density results than that by exhaustion. Either this is due to a change in the volume of the liquid, or more probably to a slight loss by evaporation when the infusion is made by raising the liquid to the boiling *point*, instead of making the bulk up after cooling.

These results show conclusively that the density of coffee infusions is remarkably constant, never exceeding 1009.

On the other hand, 10 per cent. decoctions of chicory are of considerably higher density, and exhibit greater variations among themselves. Thus: Graham, Hofmann and Campbell obtained :—

English Chicory	1021·7
Yorkshire "	1019·1
Guernsey "	1023·2
Foreign "	1022.6
	Mean 1021·65

I have recently obtained by the exhaustion plan :—

Yorkshire Chicory, under roasted	1025·9
" " same sample, highly roasted	1019·0
Unknown origin	1021·1
"	1020·0
"	1023·4
	Mean 1021·9

In calculating the proportion of chicory in a sample from the density of the infusion, it is of course desirable to err on the safe side, and this is done if we take the density of the chicory rather above than below the truth. From a consideration of the whole of the results, both recently and in 1874, I adopt 1023 as the normal density of chicory decoction, and by taking that of coffee at 1008·5, we cannot get far from the truth. If d be the ascertained density of the 10 per cent. decoction, and C be the percentage of coffee in the sample, then $C = \frac{(1023\text{-d})\ 100}{14{\cdot}5}$

Practically, as close an approximation as the above is obtainable by reckoning 7 per cent. of chicory for every degree of density over 1008·5.

In practice, the determination of the density of the infusion may be employed to ascertain the purity of a sample of coffee, a very small admixture of chicory causing an appreciable increase. Of course, however, all such methods are, in the case of coffee, mere adjuncts to the microscopical examination, by which the smallest admixture of chicory can be detected with the greatest facility. Personally, I prefer to examine with the microscope the residue left after boiling the sample in water, the troublesome colouring matter being thus removed without in any way interfering with the characteristic structure of the particles of chicory.

One of the many beneficial results of the appointment of Public Analysts has been to render nearly obsolete the various additions to coffee that were once far from uncommon. I have never officially examined a sample of coffee containing any admixture other than chicory, though I have invariably looked for leguminous seeds, cereals, &c.

The search for cereals, leguminous berries, and foreign matters other than chicory, is most readily effected by boiling the sample with water and testing the strained solution for starch. The liquid is allowed to become perfectly cold, and is then mixed with dilute sulphuric acid, and a strong solution of potassium permanganate added gradually till the colouring matter is nearly destroyed. The addition of solution of iodine then renders the recognition of any starch certain. There is no difficulty in detecting 1 per cent. in this way. A certain famous sample supposed to contain acorns gave no reaction by the above test, but after the addition of 2 per cent. of roasted acorns the test showed the presence of starch very clearly. In examining such a sample under the microscope, it is desirable first to extract all the fat with ether, and the colouring matter with methylated spirit, when the starch granules and other structures are readily perceptible.

The adulteration of coffee with mineral substances appears now to be completely obsolete, but I invariably determine the ash as a precaution.

The cold water test for chicory is convenient but occasionally misleading. As a preliminary test it is of some service.

In sorting coffees for further examination I now make the following tests:—

(*a*.) Treatment of the sample with hot water, and determination of the density of the 10 per cent. infusion, which should not exceed 1009.

(*b*.) Search for starch in strained infusion, which should give negative result.

(*c*.) Examination of the insoluble residue under the microscope.

(*d*.) Determination of the ash, which ought not to exceed 5 per cent.

Dr. Bartlett had had considerable quantities of chicory sent to him, and with the exception of four or five they had all been adulterated with some other matter. He had therefore endeavoured to set up a standard for himself, and had been quite puzzled, as the samples had varied so much more among themselves than was the case with the chicory itself. If they introduced charlot into chicory and coffee a difficulty was experienced. Where for the sake of cheapness coffee was adulterated with chicory, the chicory used would be very likely to be itself adulterated with charlot.

Mr. Hehner referred to the practice of adulterating coffee with ground date stones, and said the microscopical structure of ground date stones was not so very different from coffee, and that a mixture of coffee, chicory and date stones might give the same density as genuine coffee. As to charlot root there was one excellent test, and that is the taste. In the dried fragments it could be detected with great ease, but when once ground up it could not be detected so readily.

THE ANALYSIS AND COMPOSITION OF ENGLISH BEERS.

By T. A. Pooley, B.Sc., F.C.S.

The complete analysis of so complex a fluid as beer is attended with considerable difficulty, and the methods at our disposal are by no means so perfect as we might desire; it is, however, a subject of considerable importance, and it is therefore surprising that so few analyses have been published. Our text-books give the compositions of several kinds of foreign beer, but the analyses of English beers have been few and far between, and relate principally to the determination of two or three of the principal constituents, such as the alcohol, extract, and ash. Believing that a comparative examination of various beers brewed in different parts of the kingdom under various systems and with a variety of materials would be interesting, I have lately occupied myself in performing such a series of analyses, and in this and some succeeding papers, it is purposed to lay the results obtained before the readers. The object in view was to ascertain the exact proportions of all the more important constituents in the typical descriptions of beer brewed in this country, in order that a comparison may be made as to their respective values as foods and wholesome stimulants. Adulterants have not been especially sought for, as they are rarely, if ever, added by brewers, but the results may be of some value to brewers, who may, by comparing the analyses of beers taken direct from the brewery with those taken from retailers, be able to ascertain whether their products are offered to the public in the state of purity they ought to be. These investigations have been undertaken in no prying spirit, but simply to ascertain the exact composition of many varieties of beer; the results will naturally lead to certain deductions as to the nature of the materials used in the manufacture of each kind of beer, for that is one of the objects of the investigation, and it will be of considerable interest to trace the influence of the mineral constituents of certain brewing waters on the chemical composition of the resulting beers. This subject was taken up some time since by Mr. C. Estcourt, of Manchester, who read a paper upon the desirability of fixing some standards of value for beer, before the Society of Public Analysts at their meeting at Dublin last year,* but I cannot find that his investigations have been proceeded with; his results are, however, interesting, and I shall have occasion to refer to them again. Some analysis of Burton Ales and Dublin Porter were also made last year by Messrs. Lawrence and Reilly, and their results were communicated to the Royal Irish Academy. In the analyses which will be given in these papers, it is proposed to take a wider field, and to examine the products of many breweries in different parts of the country; for this purpose I have already either been supplied with, or promised, samples by many brewers, and I trust to the kindness of others in assisting me in the same way. No analysis of any sample of beer obtained from a brewery will be published without the consent of the proprietor, and the analyses of samples obtained from retail establishments will be described in the same way as they were bought.

To enter into a detailed and elaborate description of the processes employed in the analyses would be somewhat out of place in these pages. No claim is made to any originality of method, for as a rule, the best methods as laid down by well-known authorities on chemical analysis, have been closely followed, but when the exigency of the occasion require it, a modification has been introduced. The determinations usually made have been as follows:—Specific gravity—Original gravity—Carbonic acid—Alcohol—Extract—Acetic acid—Glucose—Dextrine—Lactic acid—Ash, including silica, lime, phosphoric acid and chloride of sodium—Nitrogen, and the corresponding quantity of albumenoid bodies.

The methods at our disposal do not enable us to determine with anything like precision the quantities of hop extract, resin and oil, or such substances as tannic acid, glycerine, and fatty bodies, and, therefore, except in a few particular instances these determinations have not been attempted. I will now describe in as short a manner as possible the general method of analysis employed, leaving to future papers some special remarks on the various precautions which have to be taken to ensure correct results.

Specific Gravity.—This has always been determined by the specific gravity bottle, and not by the saccharometer, as the last-named instrument scarcely gives sufficiently accurate results when great precision is required, on account of the impossibility of preventing the bubbles of carbonic acid gas from adhering to the bulb and stem of the instrument. The most convenient sized bottle is one holding 1,000 grains of pure distilled water at 60° F., which before use must be carefully cleaned and dried; although not absolutely necessary, it is convenient to have a weight which is the exact counterpoise of the bottle when empty; then by simply filling the bottle with the beer to be tested and weighing it, the specific gravity is ascertained. The bottle should be provided with a small stopper having a capillary tube through it; in this way great exactness of quantity can be ensured. It is of course of the utmost importance to take the specific gravities of different samples of beer at precisely the same temperature, and for this purpose 60° F. is the most usual standard, and the one I have always adopted. The specific gravity of English beers varies considerably between 1,003 and 1,012, but 1,012 is about the average.

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* THE ANALYST, vol. iii., p. 325.

Original Gravity.—This is the term employed to indicate the strength of the wort from which the beer was made, and is determined by the method which is now familiar to most brewers; it consists in distilling a known volume of the beer until at least one-half has distilled over, and then diluting both distillate and residue with distilled water to the same volume as that of the beer used; the specific gravity of each is then taken, and by reference to tables compiled for the purpose, the percentage of alcohol and extract can be ascertained; we are acquainted with the exact amount of malt extract necessary to produce a given quantity of alcohol, and therefore by adding this to the extract left after distillation, we arrive at the total extract originally present in the wort before fermentation. A correction has to be made for any acetic acid contained in the beer, but in sound samples this correction is very insignificant. Great care must be taken in observing temperatures, as the specific gravity of a fluid varies considerably with every alteration of temperature; 60° F. is the usual standard; and all the determinations of specific gravity referred to in these papers have been made at this temperature. The specific gravities have been taken by means of the bottle and not by the saccharometer, and the weighings have been made on a balance of very delicate construction. An error in taking the specific gravity of beer is liable to arise in consequence of the presence of excess of carbonic acid, and therefore it is as well always to make the determinations in the beer after it has been well shaken to remove the excess of gas.

Carbonic Acid.—This is a gaseous constituent which ought always to be present in beer, as the pleasant fresh taste of this beverage is due to this gas. The quantity varies very considerably; in bottled beer it is usually present in excess, but in cask beer the quantity is much smaller, and in some cases, where great flatness prevails, almost absent. The determination of carbonic acid is of interest under some circumstances, but as the proportion alters so rapidly when beer is exposed to the atmosphere, these determinations have but little value for the purpose of comparing one sample with another. In making an analysis of beer, it is well to previously remove any excess of carbonic acid gas by shaking the beer in a stoppered bottle until no further pressure is exerted on the stopper; in this way all the gas is not removed, but different beers are brought to the same standard as far as relates to their gaseous contents, and the results then obtained have some value for comparison.

In the analyses that will be given in future papers, all beers will have been thus treated, except in some cases of which special mention will be made. In case the determination of carbonic acid is necessary, the following method may be employed. A known quantity of beer, say 100 cubic centimetres is placed in a good sized glass flask connected by means of a cork and bent tube with a vessel containing a quantity of a solution of hydrate of baryta. This vessel must be carefully protected from the atmosphere in order that no carbonic acid is absorbed from that source. Upon heat being applied to the flask, the gas is gradually expelled, and having to bubble through the baryta water is all absorbed, with the formation of carbonate of baryta, which, being insoluble in water, separates in the form of a white powder. After all the gas has been expelled, this precipitate is filtered off and washed thoroughly, and is weighed in a platinum crucible with the usual precautions; 197 parts of carbonate of baryta are equal to 44 parts of carbonic acid gas, and therefore by a simple calculation it is easy to ascertain the quantity of gas present in the 100 cubic centimetres of beer employed in the experiment. Great care must be taken that the gas is not given off too rapidly, otherwise some of it may escape absorption in the baryta water, and in filtering off the precipitate rapidity is important, otherwise there may be absorption from the atmosphere. As it is impossible on the present occasion to find space for the remainder of the description of the method of analysis employed, I will conclude with giving the results obtained with one sample of beer.

Analysis of sample of 4d. beer obtained from a publichouse in Messrs. Truman, Hanbury & Co.'s trade :—

Specific gravity of beer	1012·16	
" " distillate	992·45	
" " residual extract	1019·75	
Original gravity of beer	1050·97 = 18·36 lbs. per barrel.	
Alcohol		4·200 per cent.
Total extract*		4·810 "
Acetic acid		·034 "
Carbonic acid		·132 "
Water by difference		90·824 "
		100·000 per cent.

*Total extract contains the following constituents :—

Glucose			1·390 per cent.
Dextrine			2·060 "
Lactic acid			·058 "
Ash containing	Phosphoric acid	·046	·476
	Lime	·603	
	Chloride of sodium	·115	
Nitrogen		·029	
equal to albuminous substances			·204 "
Extractive matters of the hop, fatty bodies, glycerine, &c., by difference			·622 "
			4·810 per cent.

In the next paper the description of the method of analysis employed will be concluded, and further examples of the results obtained will be given.—*Brewers' Guardian.*

NEW METHOD OF DETERMINING IODINE IN THE PRESENCE OF CHLORINE OR BROMINE.

E. Donath.

(Zeitschr. f. Anal. Chem. XIX., p. 19).

A solution of pure chromic acid added to a solution of an iodide liberates the whol of the iodine, whilst it is without action upon chlorides or bromides. On distilling th liquid containing the precipitated iodine the whole of the latter readily passes into th distillate, wherein it can be determined by titration with standard hyposulphite.

25 c.c. of a solution of KI, which furnished 0·6210 and 0·6220 of Ag. I, and therefore contained on the average 0·3358 of iodine, was distilled with 50 c.c. of a chromi acid solution of 2½—3 per cent. strength, until no more violet vapours could be observed The distillate required 26·2 c.c. of deci-hyposulphite, corresponding to 0·3327 grams o iodine. In two other experiments, 0.3352 and 0.3327 were obtained.

1 gram. of K. Br. distilled for a few minutes with 50 c.c. of the same chromi acid solution furnished a distillate which consumed but 0·2 c.c. of deci-hyposulphit solution. On continuing the distillation until about one half of the total liquid ha gone over, appreciable quantities of bromine were present in the distillate; hence, th operations must be conducted with dilute liquids if bromine be present.

Neither K Cl nor Na Cl yielded the slightest quantity of chlorine.

Hence the method is well adapted for the separation of I. from Cl., and in a les degree from Br.

It is similar in principle with that described by *Dujlos* (Apothekerbuch), and i which ferric salt is employed to liberate the iodine.

O. H.

REVIEWS.

How to Use a Galvanic Battery.

By Dr. Tibbitts. London: Churchill.

This small volume is more strictly medical than chemical, but the author ha treated his subject in such a bold and masterly way, that it really takes it out of th domain of an exclusively medical work. Starting with the idea—in which we full agree—that a medical man is perfectly qualified for his work without being an electrician the author follows out his aim of giving a manual for those practitioners who desire t use electricity, which shall give general guidance for its judicious application to curativ purposes. He lays special stress on the uselessness, and in some cases the injury whic is effected by the reckless application of currents of unknown strength to delicate organ which have already been rendered over-sensitive by disease. It is true that th directions which Dr. Tibbitts gives are not nearly so complete as could be wished but he has certainly succeeded in warning others against trying electrical experiment in reference to which they have but a small proportion of the information that he ha evidently acquired; and he has the courage of his opinions in advising medical men who know but little of the subject, to send their patients to professed electricians for th special treatment.

A Treatise on Waterworks for the Supply of Cities and Towns.

By S. Hughes, C.E. London: Lockwood & Co.

This is a reprint of an old book with additions. We might, perhaps, find fault with the title, as it is scarcely complete enough. An ordinary reader would hardly search for information as to geological strata, and for tabulated statements as to a large number of the most important deep wells which have recently been sunk, in a book bearing this title, and yet the information compressed under these heads is of the most valuable character for reference, and is put together in such a form as to be easily available. The sections on pumping machinery, gauging rivers and streams, and filtration on a large scale do certainly belong specially to waterworks, and they are as complete and satisfactory in their way as the others to which we have alluded. The book is a very useful one and well worthy to hold a place in Weale's well-known series.

Lectures on Infectious Diseases, Air, Sewage, &c.

By Dr. J. Russell and Dr. W. Wallace. Glasgow: Maclehose, St. Vincent Street.

It is very seldom that a Town Council orders the printing of any lectures or other book which contain really valuable scientific information, but in this case we have a marked deviation from the ordinary rule. The volume under notice consists of lectures which were delivered by Dr. Russell and Dr. Wallace, at Glasgow, in the latter part of 1878, and which have now been published for more general circulation. The part with which we have to do relates more especially to the four lectures by Dr. Wallace on Air, Water, Sewage, and Food. He has treated his subjects in a thoroughly careful way, and, as far as the limits of space would allow, in an exhaustive manner. There are many points in connection with the Food lecture which are well worth careful reading, and show that the lectures have not been published simply as ordinary matter intended to instruct the masses, but as chemical studies, including a considerable amount of genuine work. The lecture on Sewage necessarily contains less original matter, because the subject has been so thoroughly threshed out during the last ten years. that there really is nothing to be said until some one invents a new process. Dr. Russell's lectures are illustrated with a few enlarged micro-photographs, such as human blood in various stages of disease, which are well worth attention.

REMARKABLE EXPLOSIONS.

Explosion of a Diamond.—At a recent meeting of the Academy of Natural Sciences of Philadelphia, Professor Leidy exhibited a black agate sleeve button, which had set in it centrally, raised in a gold setting, a rose diamond, about 7mm. broad. It had been submitted to him by Mr. Kretzmar, a jeweller, who informed him that the person who wore it was recently leaning with his head upon his hand on a window ledge in the sun, when the diamond exploded audibly and with sufficient force to drive a fragment into his hand and another into his forehead. On examining the diamond the fractured surface, following a clearage plane, exhibited apparently the remains of a thin cavity such as is sometimes to be seen in quartz crystals. The fracture also exposed a conspicuous particle of coal. Professor Leidy thought that the explosion had been due to the sudden expansion of some volatile liquid contained in the cavity, as frequently occurs in cavities in many minerals. Mr. Goldsmith thought it possible that the liquid was carbonic acid, as he was impressed with the idea that diamonds originated from this material in the liquid condition.

Explosion of Carbonic Acid.—Attention was recently directed in the French Academy to a case of explosion of carbonic acid which occurred in July last in one of the coal pits of Rochebelle (Gard). The coal strata there are much dislocated, and the carbonic acid, generated plentifully in the neighbourhood, and finding its way through natural passages, seems to have accumulated in certain parts with sufficient tension to explode with two loud detonations, driving a large quantity of fine coal into the galleries. Three men were asphyxiated, and two others were only able to throw themselves in a swooning state into the cage and be hauled up. That no flame was present (as in explosions of fire damp) is proved by the absence of burns on the bodies of the victims, the fact that blasting cartridges did not go off, &c. The gas is thought to have arisen from sulphuric acid (produced through oxidation of a stratified mass of pyrites) dissolving in subterranean waters, and finding its way down to triassic limestone.

In the works of M. Kuhlmann lately an alembic of platinum, about 90 centimètres diameter, used for producing daily some 6,000 to 7,000 kilog. of concentrated sulphuric acid, was exploded, the component pieces being shattered and thrown out. with bricks of the fireplace, 20 to 30 mètres in different directions. Fortunately a slight hissing was observed a few seconds previously, so that the workmen had time to escape a terrible fate. The nature of the explosion M. Kuhlmann supposes to be as follows :—This platinum apparatus was being cleaned; some 30 to 40 kilogrammes of concentrated sulphuric acid had been left in it; on this some water had been admitted through the siphon, and the whole had been gently heated three or four hours. It is known that mixing sulphuric acid with water produces a good deal of heat; in the present instance, combination is thought to have taken place instantaneously, at a pretty high temperature, generating a large amount of vapour. From *data* furnished by Fabre and Silbermann, it appears that 40 kilogrammes of acid at 18 deg., with water, is capable of producing instantaneously 18 to 20 cubic mètres of vapour, and this is sufficient to explode a platinum vessel of about 300 litres capacity and only 2 to 3mm. thickness. As the combination occurred at about 100 deg., the force would be greater. M. Kuhlmann has repeated the explosion several times in laboratory experiments, and he finds that it always occurs with great violence where the quantity of water is at least ten equivalents for one of acid. In presence of the difficulty of mixing these two substances, which have a very great affinity, but the density of which is so different that they may remain several hours one on the other without mixture and consequent combination, the need of cautious management is obvious.

LAW REPORTS.

COURT OF APPEAL.

Label as to mixture of Chicory and Coffee no protection to vendor if Pure Coffee asked and paid for. Conviction by Magistrates affirmed on appeal :—

LIDDIARD *v.* REECE.—In this case heard in the Queen's Bench, on 29th Nov. last, before Mr. Justices Lush and Manisty, a question of some general interest, having reference to the mixing of chicory and coffee was raised. The case was that a grocer had sold half a pound of an article of food called coffee to the prejudice of the purchaser, "the same not being of the nature, substance, and quality of the article demanded by the purchaser," contrary to the terms of the Act 38 and 39 Vic., cap. 63. The case was stated thus by the magistrates :—"Upon the hearing of the aforesaid information it was proved on the part of the respondent and found as a fact that on the 23rd of May, 1879, one Stephen Shepherd, a police-constable of the Berks Constabulary, stationed at Reading, went to the appellant's grocer's shop in Faringdon, in plain clothes, and asked one of appellant's assistants to supply him with half a pound of coffee. The assistant took a quantity of what appeared to be coffee from the bulk contained in a canister and weighed it, after which it was wrapped up in paper and delivered across the counter to the purchaser, who paid 9d. for the half pound, this being the full price for pure coffee. The purchaser then asked the assistant to call his master, the appellant, which he did, and the appellant came to the purchaser, who then informed him that he had purchased the article for the purpose of having it analysed. The appellant thereupon, while the packet was still on the counter, called the purchaser's attention to a label affixed to the outside of the paper in which the article was wrapped, on which the purchaser noticed for the first time the following printed words,—'This is sold as a mixture of chicory and coffee.' (A *fac-simile* of the paper and label was annexed). The words were printed in distinct and legible characters, and the label was affixed in a conspicuous position on the outside of the package. The purchaser then said he had asked for 'coffee' and not coffee and chicory. He then, in pursuance of the provisions of the 14th section of the said Act of the 38 and 39 Vic., cap. 63, informed the appellant of his intention to have the article analysed by the Public County Analyst, and offered to divide the same into three parts, and deliver one of such parts to the appellant; but this the appellant did not require him to do. The purchaser had no suspicion that he had received anything but pure coffee until his attention was drawn to the label by the appellant. The article was afterwards, on the 24th of May, 1879, submitted for analysis to Mr. W. F. Donkin, of the University Museum, Oxford, the Public Analyst for the county of Berks, who by his certificate, dated the 27th of July, 1879, which was given in evidence by the respondent, declared the result of his analysis in the following terms,—'I am of opinion that the said sample is a mixture of about 60 parts coffee with about 40 parts chicory.' The appellant was represented by a solicitor, who submitted that the appellant was protected by the 8th section of the Act, with the terms of which he had fully complied by having at the time of delivering the article supplied to the purchaser a notice by a label, distinctly and legibly printed, that the same was mixed, and the appellant's solicitor cited and relied on the case of 'Sandys, appellant, *v.* Small, respondent,' decided in the Queen's Bench Division on the 26th of June, 1878 (3 "L. R.," Q. B., 449,) in support of his contention, and urged that on the authority of this case it was unnecessary to call the attention of the purchaser to the label. The 8th section of the Act provides that 'no person shall be guilty of any such offence as aforesaid in respect of the sale of an article of food or a drug mixed with any matter or ingredient not injurious to health, and not intended fraudulently to increase its bulk, weight, or measure, or conceal its inferior quality, if at the time of delivering such article or drug he shall supply the person receiving the same notice by a label distinctly and legibly written or printed on or with the article or drug to the effect that the same is mixed.' We, however, having regard to the fact that the purchaser asked for coffee, and was supplied with an article consisting of only 60 per cent. coffee and 40 per cent. chicory, without having his attention called to the label, and without, in fact, seeing it until the purchase was completed, and also to the fact that the price he paid for the said article was a usual and fair price for pure coffee, and much more than would have been given for coffee mixed with chicory to the above extent, and also conceiving that the case cited by the appellant's solicitor, which referred to a mixture of water with whisky, was not applicable to the case before us, were of opinion that the article sold was so mixed with intent fraudulently to increase its bulk, weight, and measure, and considered that, therefore, the appellant was not protected by the said 8th section of the Act, and we convicted him in the mitigated penalty of £5 and costs as before mentioned. The questions of law arising on the above statement for the opinion of this Court are :—Whether the admixture of chicory with coffee to the extent of 40 per cent., the same being sold at the usual price of pure coffee, is to be considered a mixture of an ingredient or matter intended fraudulently to increase its bulk, weight, or measure within the meaning of the 8th section of 38 and 39 Vic., cap. 63, so as to deprive the appellant of the protection that would otherwise be afforded him by the said section. And whether, assuming this question to be answered in the negative, after the completion of the sale and delivery of any mixed article sold as pure, but before its removal from the counter, the seller can avail himself of the protection afforded by the latter part of the section by calling the purchaser's attention to the notice of mixture printed on the label. If the Court should be of opinion that such conviction was legally and properly made, then the said conviction is to stand; but if the Court should be of opinion otherwise, then the said information is to be dismissed." Mr. Mellor, Q.C., and Mr. Latham were for the appellant, the grocer who was convicted; Mr. Lawrence and Mr. H. D. Green were for the complainant, in support of the conviction. The Court after hearing the counsel for the appellant, without calling on the other side, affirmed the conviction. Mr. Justice Lush said that they quite agreed with the magistrates in their finding. No one could tell the proportion of chicory. Mr. Justice Manisty said that the mixture was sold for the full price of coffee and suppose the purchaser could not read? Conviction affirmed.

Milkmen selling Milk in the Street, bound to serve Inspectors when required. Convictions for refusing :—

Mr. Marsden, the Vestry Clerk of Camberwell, attended at the Lambeth Police Court in support of summonses taken out against tradesmen for refusing to serve the inspectors appointed by the Vestry. The matter was first before the Court a fortnight back, when, after hearing some evidence, Mr. Chance considered there was some doubt on a point of law, and directed a remand. The first case called on was that of John Parker, dairyman, of Hanover Street, Peckham. Evidence was given showing that Inspector Fisher had asked a servant of defendant, who was selling milk in the street, to serve him with a pint of milk. The defendant's servant declined to serve the inspector, stating that all he had was ordered for regular customers. Mr. Chance, after hearing arguments put forward by a gentleman from the office of Mr. Ricketts for the defendant, said he had fully made up his mind that the inspectors were, under the Act, bound to be served in the street, but he would adjourn this case in order to have the man in defendant's employment summoned, so that both matters might be dealt with. Mr. Chance said there were other cases before him that day, and he wished to say that he had well considered the sections of the amended Act. It would no doubt be a great difficulty to ascertain if milk was adulterated, if a man carrying it through the streets to serve regular customers, refused to serve an inspector. It appeared to him that the amended Act was intended to meet a difficulty which previously existed. The Act also was a protection to the customer who might have ordered milk, and who otherwise would be at the mercy of the parties who served him. If such a law was not carried out, large quantities might be sold without the inspectors being able to ascertain if it was pure or not. If he gave force to the argument used by the gentleman who appeared for the defendant, the Act might become nugatory. He certainly should convict in such a complaint, but would grant a case for the opinion of a Superior Court if asked for. He intended to hold that an inspector had a right to ask and be served with milk in the street. William Jenkins, cowkeeper, of Cornwall Road, Peckham, was summoned for refusing to serve Inspector Fisher. On the 18th ult. the inspector met the defendant, with some milk, and asked him to serve him with a pint, and told him he wanted it for analysis. The defendant was driving a horse and cart, and drove on. He followed and again asked to be served. The defendant wanted to serve him out of a particular can, but the inspector wanted it out of another. The defendant then said first that it was "All ordered," and afterwards, when he found the inspector was putting down his name and address, said, "Well, the other can contains milk and water." Mr. Chance, after hearing corroborative evidence, said it was a bad case, for the defendant knew well he was carrying for sale a can of milk and water. He ordered him to pay a fine of £5 and costs. George Barnes, Loder Street, Peckham, milkseller, was also summoned for a similar offence. When asked by Inspector Fisher for a pint of milk, he made the usual excuse that all he had was ordered. Mr. Chance said such an excuse would not avail, as he had before remarked, and the Act would be carried out. He ordered the defendant to pay a penalty of 40s. and costs.

NOTES OF THE MONTH.

On November 28th, in the Court of the Queen's Bench, before Justices Lush and Manisty, as shortly mentioned in our last number, a case was decided which, according to a trade contemporary, "distinctly marks a new departure" in the law of adulteration. The facts of the case, as stated by the respondent magistrates whose decision was appealed against, were as follows:—A police-constable went into a grocer's shop and asked for "half-a-pound of coffee," which was duly taken from a canister, weighed, wrapped up, and delivered across the counter, while the sum of 9d. was charged and paid, such being the price of good coffee at 1s. 6d. per lb. On the constable stating that the article was for analysis, the proprietor came forward, and while the packet was still on the counter the latter called the constable's attention to the fact that it was a mixture as indicated by the words printed on the paper, "This is sold as a mixture of chicory and coffee." On analysis the article was found to contain, coffee, 60 parts and chicory, 40 parts, and the correctness of this result was not disputed by the defendant; but he relied on the 8th section of the Act, providing that a person selling a mixture may label the same and so be exempt from punishment. The Magistrates, however, held that in the present case the purchaser's attention had not been called to the label in reasonable time, and moreover they considered that, seeing the purchaser asked for coffee and paid the price of coffee, he should be protected against being served with a mixture which he did not desire, and they therefore convict the defendant, who now appealed. The Court, after hearing the appealing counsel, and without requiring any reply, unanimously upheld the conviction, and in doing so, Mr. Justice Manisty particularly commented on the fact that coffee was asked for *and that the* full price of pure coffee was paid for the article.

The decision, based as it is on principles of fairness and justice, of course gives umbrage to the *Grocer*, who fights hard for the right of a man to sell an inferior article at the price of the best whenever he can get a chance by sticking on a label, which, in 99 cases out of 100, would never be noticed by the purchaser. How often there must have been a chuckle of quiet delight when this was done (as indeed it is daily), but now the chuckle is changed into a groan of dismay, and the periodical in question waxes wroth, and has a little quiet dig at the analyst whose decision was *not* disputed and who had done nothing but his simple duty. A long article is devoted to showing how the unfortunate tradesman's defence is cut from under him, and that the Act was meant to protect him in this style of dealing. How much better would it be if the *Grocer* encouraged its constituents in business habits, and told them what the law demands, namely, that when a grocer is asked for "half-a-pound of coffee" he should honestly sell "half-a-pound of coffee," and neither dodge his customer by giving short weight or adding chicory.

Both in the article and in the letters on the subject published in the *Grocer*, the real gist of the case is entirely omitted, namely, that *coffee was asked for and the full price of pure coffee paid*, and yet a mixture was sold. What the Court has ruled has no reference whatever to a man who openly sells a mixture as such, but it is that the 8th section of the Sale of Food and Drugs Act should be no protection to deliberate attempts at fraudulently supplying a mixture when a pure article is asked and paid for.

The great difficulty as to morality is that no one likes to begin to practise it, lest his neighbour over the way should get an advantage. If, however, trades organs would only encourage it a little more, perhaps we may come to the happy day, when, in reply to a demand for 1s. coffee, the salesman will say, "Real coffee cannot be sold at less than 1s. 6d., but you will find this 1s. mixture very good." A little of this straightforward dealing and the public would soon learn the fact, and ask for "coffee" or "mixed coffee" according to their means or their taste. Surely it is better to agree to such a course than to spend money on attempts to legally bolster up the right of practising tacit deceit, and it would save the necessity of reading diatribes on analysts and other such pabulum calculated to encourage what is now legally condemned.

The great case of the Norwich Baking Powder—which it seems is a mixture of alum and bi-carbonate of soda, has been decided against the manufacturers, and appealed. Our readers who perused the report in our last number will doubtless watch with interest the evidence to be given on appeal. Mr. Sutton was actually, and Dr. Tidy is, it seems, expected to be, called for the defence, both having given certificates that it was quite uninjurious. Supposing an inspector in either of their districts bought some bread, and they, not knowing that this powder had been used in making it, certified to the article containing 118 grains of alum per 4-lb. loaf (which it was stated in court that a loaf made with the article would contain), what an amusing scene might be made in the witness-box when it was proved that the alumina got in through the employment of the very compound they had previously declared perfectly allowable. It is evident that if this appeal succeeds, there is an end to any prosecution for adding alum to bread, as the baker would only need to say he did not use alum, but

Norwich Baking Powder. We think that Public Analysts would be wiser (even at th cost of sometimes losing good fees) to decline giving evidence in any disputed case There are plenty of men—not Public Analysts—who would only be too thankful to g employed in such affairs, and the individual action of any public man would not be thu cramped. If really consistent in their views, then the public in certain districts mu be content to eat what is elsewhere deemed undesirable, merely because the analyst h publicly bound himself to an opinion on the subject which might be afterwards used t impair the efficiency of his evidence in official prosecutions.

Our readers will note with interest the final decision of Mr. Chance, th magistrate for Lambeth, as to the right of inspectors to demand samples in the stree and we are glad to find he has not adhered to the opinion which we commented upo last month. To look after the milk thus sent out to customers, as well as that sol over the counter, is the only true way of ensuring that the public get what they pay fo

NOTICES TO CORRESPONDENTS.—X. Y. Z.—We agree with your remarks as to the imperfection of th publication in question, and have already pointed them out, and we knew that an effort has in cons quence been made to improve it. We have not space this month for your letter. Dr. SWETE.—Ou matter was all in type before your letter arrived.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can b obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879. No.	Name of Patentee.	Title of Patent.	Pri
1592	W. Müller	Manufacture of Ammonia from Nitrogen of Atmospheric Air and Hydrogen	6
1622	R. C. Thompson	Producing Electric Light	2
1635	J. MacKenzie	Electric Light Apparatus	6
1661	J. C. Mewburn	Preparation of Starch and Dextrine	4
1673	J. J. Sachs	Extraction of Fatty Matters	2
1698	H. A. Bonneville	Dephosphorization of Iron	4
1703	J. Townsend	Obtaining Soda and Potash	4
1705	A. Steenberg	Manure	2
1733	R. S. Ripley	Treating Illuminating Gas	6
1783	F. C. Glaser	Manufacture of Sugar	4
1791	J. S. Sellon and H. Edmonds	Electric Lamps	2
1692	Ditto	Regulating Electric Currents	6
1949	Ditto	Apparatus for Generating Electric Currents	2
1795	A. M. Clark	Safety Cheque	2
1808	H. J. Haddan	Gas Governors	4
1842	W. R. Lake	Machinery for Crushing Phosphates	4
1855	J. B. Spence	Treatment of Metallic Sulphides	4
1865	H. Parkes	Manufacture of Compounds of Nitro-Cellulose	4
1869	A. Scott and T. R. Ogilvie	Purifying Saccharine Substances	4
1970	J. Fordred	Treatment and Purification of Cod Liver Oil	4
2652	C. W. Siemens	Electric Lamps	2
4103	W. Morgan Brown	Electric Batteries	6

BOOKS, &c., RECEIVED.

Annals of Chemical Medicine, by Dr. Thudichum; How to use a Galvanic Battery, by Dr. Tibbitts Water Works for Cities and Towns, by S. Hughes; Blowpipe Analysis, by Landauer; A Year Cookery; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; Th Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applie Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; Th Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientif *American; The American* Traveller.

THE ANALYST.
FEBRUARY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

The Annual Meeting of this Society was held on the 15th January, at Burlington House, Piccadilly, the President, Dr. Muter, in the chair.

The minutes of the previous meeting were read and confirmed.

The President delivered his Annual Address as follows :—

Gentlemen, it is customary for the retiring President of our Society to say a few words of farewell, coupling them with remarks upon the general position of the Society and the working of the Act of Parliament under which we all hold office. I am glad to say that the past year, so unfortunate to many both at home and abroad, has been comparatively gentle to us, seeing that we have only lost two members by death, namely, Messrs. H. Goode and J. Whitla, with neither of whom had I the pleasure of a personal acquaintance, but I have understood from those who had, that they were men making their mark on the sands of time, now alas, too soon washed out by the tide of eternity. During the year one member has resigned, and two have been struck off by the Council for non-payment of their fees, but to make up for this loss five new members have been elected, thus keeping " our balance true " up to the moment. So that we stand now with 90 members and 12 associates, being a total gain of 2 in the last 12 months. We are also more fully endowed with that very necessary article called " worldly dross " by those who have not got it, seeing that although our payments have increased by £18 on account of The Analyst, we have still a balance at our bankers which is £2 better than last year. Gentlemen, our Society is not and never can be large, because it is limited to a certain class, and owing to the vast preponderance of country members our meetings may not be very numerous, but still we have a distinct *raison d' être*, and we carry that out to the letter. You will excuse me imitating Mr. Silas Wegg, and " dropping into poetry " unconsciously, but after all it is something to boast of that we do act up to our aspirations, which is more than can be said of all other scientific associations. We do not pretend to elevate the morals of our members and then find ourselves helpless when cases arise requiring such elevation, neither do we pretend to raise the fees receivable for work done and then find that we have upon our Council some most notorious offenders in that respect, nor do we get up discussions on subjects specially the province of other societies, and end them in smoke. What we do profess we carry out, namely, to improve the process of analysis in all matters relating to food. Germany is and has always been looked up to as the foster-mother of general chemical discoveries, but for research in our special subjects we must look at home; and everyone must admit that Great Britain is up to the present the source of special food research, and that all which has been done has been mainly attained by the members of the Society of Public Analysts. During the last year we have had either read here or published in our journal (The Analyst) no less than 41 memoirs, relating to our branch of the chemical profession, and that, remember, all carried out, not by wealthy *dilletanti* or men receiving grants from research funds, but by persons daily and actively engaged in carrying out the complex and tedious duties thrown upon them by an Act of Parliament. Let us, gentlemen, strive to keep the position so nobly attained, and let us one and all resolve to do more and more every year in the grand cause of the advancement of our art, so that we may keep pace with our enemies, the adulterators, and let the public of Great Britain have that most precious of boons, namely, pure food and drugs.

As regards the Act and its working we must congratulate ourselves that, oiled by the good lubricator—time, our wheels move smoother every year. More and more our processes and modes of interpretation of results continually receive general acceptance, and closer do we and our Appeal Court at Somerset House draw to each other. I believe sincerely that Mr. Bell and his colleagues try most earnestly to elicit the truth, and were they only freed from the absurd restriction which prevents their coming amongst us and letting us know their standards and experimental results, there would hardly ever be the difference of a decimal point between our conclusions and theirs. We must, however, trust to time, and I can only hope the day is not far distant when the heads of the Somerset House Laboratory will be found enrolled among us, and helping, as we do, to disseminate the knowledge of food analysis, instead of being compelled to keep their results locked up through a piece of Government red tapeism. The amended act of last session has proved a great public good in the case of peripatetic vendors of food, who were before enabled to carry on, without fear, the most barefaced schemes of adulteration; and the recent decision of the High Court to the effect that if a man asks for an article and pays the full price for it he is distinctly entitled to receive that article in a state of purity, notwithstanding any declaration or notice to the contrary, is a distinct advance in equity in the interests of the public. Gentlemen, with these few words I will bid you *adieu*, hoping that we may all meet again at our next anniversary improved in knowledge and with the full consciousness that we have each given our stone to the grand cairn of the science of food analysis now being erected in our midst, so that our successors in the next generation may have reason to be thankful for the establishment of the Society of Public Analysts.

Mr. Allen proposed a vote of thanks to the President for his address, and hoped that it would be published not only in THE ANALYST but in other journals, as it showed what a large amount of real scientific work Public Analysts had done within a very short time.

Dr. Dupré, in seconding the vote, expressed a similar hope, and said that if their fellow chemists in England once became aware of the good work they were doing, the Society would rise considerably in their estimation. He took the opportunity of saying that he thought there should be a little more *esprit de corps* among the members, which was one of the greatest reasons for establishing the Society. He also said that as no analyst could pretend to know everything, it would be very wise if a member, when he had an article with which he was little acquainted, would write to the secretaries, who would always know the best member to give any required information.

The proposal having been unanimously agreed to, Dr. Muter returned thanks.

The President proposed that the thanks of the Society be given to the Council of the *Chemical Society* for the use of their rooms for meetings, which was unanimously agreed to.

The President proposed a vote of thanks to the Members of Council for their attention to the business of the Society during the past year, which was also agreed to.

The President proposed a vote of thanks to the Secretaries, Messrs. Heisch and Wigner, for their services during the past year, which was also agreed to.

Mr. Angell and Mr. West-Knights were appointed Scrutineers to examine the voting papers for the election of Officers and Council, and they reported that the following were elected :—

President.

J. Muter, Ph.D., M.A., F.C.S.

Vice-Presidents.

A. Dupre, Ph.D., F.R.S., F.C.S.
J. W. Tripe, M.D.
A. Wynter Blyth, M.R.C.S., F.C.S.

Treasurer.

C. W. Heaton, F.C.S.

Hon. Secretaries.

Charles Heisch, F.C.S.
G. W. Wigner, F.C.S.

Other Members of Council.

J. Carter Bell, F.C.S.
J. Campbell Brown, D.Sc., F.C.S.
C. A. Cameron, M.D., F.R.C.S.
Bernard Dyer, F.C.S.
Otto Hehner, F.C.S.
W. Morgan, Ph.D., F.C.S.
W. Wallace, Ph.D., F.C.S.

The names of those Members of Council who did not retire this year, are—

M. A. Adams, F.R.C.S.
A. H. Allen, F.C.S.
H. C. Bartlett, Ph.D., F.C.S.
A. H. Church, M.A., F.C.S.
F. Maxwell Lyte, F.C.S.

The Scrutineers also reported that Professor C. R. C. Tichborne, Ph.D., F.C.S., Public Analyst for Longford County, and President of the Irish Pharmaceutical Society, was elected as a Member.

Mr. T. P. Bruce Warren, analytical chemist, was proposed as a Member, and Mr. L. Stansell, assistant to Mr. C. H. Piesse, as an Associate.

Mr. Wigner read a paper by himself and Professor Church on "Two Ancient Samples of Butter."

A paper by Mr. Carter Bell, "On the Composition of Unfermented Wines of Commerce," and one by Mr. W. M. Hamlet, "On the Estimation of Fat in Milk," were also read.

After the meeting the members dined at the Café Royal, and passed a pleasant evening together.

The next Meeting of the Society will take place at Burlington House, on Wednesday, the 18th February.

ON TWO ANCIENT SAMPLES OF BUTTER.

By G. W. Wigner, F.C.S., and Professor Church, M.A., F.C.S.

Read before the Society of Public Analysts, on 14th Jan., 1880.

The specimen of Irish bog-butter which we have submitted to analysis cannot be traced with any certainty to a particular locality. There is no doubt, however, that it is a perfectly authentic specimen, some centuries old; indeed, we should probably be right in concluding its age to be not less than 1,000 years.

Whether the specimens of ancient butter found in the bogs of Ireland, and occasionally in those of the Faeroe Isles, and of Scotland, were originally inhumed for the sake of security, or for their preservation and ripening, we have no means of ascertaining. They are inclosed in rough wooden vessels, square, oblong, or cylindrical, sometimes consisting of a hollowed tree trunk. A fine example of the last-named form is preserved in the museum of the Royal Irish Academy, at Dublin, and is figured and described on pages 212 and 268 of their museum catalogue. For the history and archæology of bog-butter, reference may be made to Dr. Wilde's paper in the proceedings of the Royal Irish Academy, vol. vi., p. 369, where will be found a list of the authorities who have discussed the subject.

Bog-butter has been chemically examined by Prof. E. Davy in 1826 *(Proc. Roy. Dublin Soc.)*; by Williamson *(Ann. Ch. Pharm., 1845, liv., 125)*; and by Brazier *(Chem. Gaz., 1852, 375)*. Brazier concluded that it mainly consisted of an acid, having the same composition as palmitic acid, and melting at 53° C.

We will describe the physical and chemical characteristics of the sample we have examined. It weighs nearly five pounds. In shape it is an irregular oval, about twelve inches by eight inches, and six inches thick. The surface is deeply indented in many places, and some of these indentations present such an appearance as would be produced by the pressure of the stave of a cask. The general appearance of the sample leads to the opinion that it has been enclosed in a rough cask or tub of an oval form, and as that decayed, an irregular pressure has been brought on to the substance. There are several clearly cut cylindrical holes through the sample: these holes are much like those which would be produced by a cork-borer or a cheese-taster. The surface of the sample bears a resemblance to a very old and dirty cheese. The interior is of an almost sandy colour, and although somewhat like cheese in texture, it is more friable and pulverulent. It has a slightly greasy feel to the fingers, and a slight but distinct odour of cheese, not butter.

A small portion from the inside of the mass was examined microscopically. A few fragments of foreign matter did polarize, but the bulk of fat did not, and no trace of crystalline structure could be detected. A good deal of foreign matter, partly curd, was seen.

The sample fused very slowly, even at 212° (100° C.), and the curd and foreign matter separated with considerable difficulty. The fat which adhered to the curd was removed by washing with ether, but was not used in the subsequent analysis of the fat. The original sample contained :—

Moisture	1·40	per cent.
Curd, fibre, and other matters insoluble in ether	3·98	,,
Ash*	·32	,,
Fatty Matters	94·30	,,
	100·00	

*Containing Chlorine ·033 = Chloride of Sodium ·054.

The curd was microscopically examined. It contained a considerable proportion of vegetable matter, and some large fragments of wood, the structure of which was too much destroyed to enable the species to be identified. The largest of these fragments was nearly a quarter of an inch long. The curd also contained some fungoid growths and mycelium. A considerable proportion was, however, clearly of animal origin; many fragments of muscular tissue were found, and some hairs. These were quite sufficient to prove the fact, that the fat itself was of animal origin, although it was mixed with some proportion of vegetable matter, which was probably derived from the bog.

This curd and other matters insoluble in ether gave the following results:—

Nitrogen by soda lime process	3·64	per cent.
= Casein	23·05	"
Ash	8·70	"
Containing Chlorine	·82	"
= Chloride of Sodium	1·35	"
Fibre (crude Cellulose)	27·60	"

The fatty matter, after separation from the curd, was very dark coloured. It contracted greatly when cooling, and was almost or quite as hard and resonant, when struck, as a good sperm candle.

Its melting point was 121° F. (49·5° C.).

Its specific gravity, taken at 155° and compared with water at the temperature of 100° F. (38° C.), was 875·4.

Assuming that the ratio of expansion is fairly accordant with that found in the fats previously examined by one of us[*], this would correspond to an actual density of ·902 at 100° F. (38° C.).

The fat was saponified with alcoholic soda in the usual way, the soap decomposed with acid, and the washings containing the soluble fatty acids distilled.

The whole of the processes were carried out by flask washing, to avoid loss.

The following results were obtained:—

Volatile fatty acids, calculated as butyric	·06	per cent.
Soluble fatty acids, not volatile	·42	"
Insoluble fixed fatty acids	99·48	"
Glycerin	Minute traces.	

The insoluble fatty acids were converted into lead salts, and the oleate of lead separated by ether. The results were:—

Oleic acid	9·0	per cent.
Stearic and palmitic acids	91·0	"

The distillate certainly had a faint, though of course very slight, smell of butyric acid; enough however to prove its presence.

The traces of glycerin were far too small to admit of any approach to estimation.

It is interesting to observe how complete has been the decomposition of the original glycerides of the butter, both the resulting glycerin and the soluble fatty acids set free, having been almost entirely removed by the action of water only at a low temperature. Time has been an important factor in the change.

The other sample of butter is much older. It was taken some time ago from an Egyptian tomb, which probably dates from about 400 or 600 years before Christ. The sample is therefore nearly 2,500 years old. It was contained in a small alabaster vase, and had apparently been poured in while in a melted state.

The vase was brought by Lord Prudhoe from the Delta. It bears an inscription in hieroglyphics, indicating that it was once the property of *Hasheps*, a queen of the 18th dynasty. It is quite possible that the butter was once perfumed, serving the purpose of an ointment; but if so, every trace of such perfume has vanished.

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[*] THE ANALYST, vol. iv., p. 183.

In appearance, colour, smell, and taste, it corresponds closely with a sample of slightly rancid butter.

The quantity at our disposal—some six grains—was so small, that it was only possible to apply a few tests.

Under the microscope the sample polarized distinctly.

It was entirely soluble in ether.

It melted readily, and showed no infusible residue.

It was practically free from moisture and from ash.

The fusing point was 127·5° F. (53° C.).

A small quantity was saponified, and the soap was decomposed in a small flask.

The soluble fatty acids were found to be 8·0 per cent. by direct weighing.

The washings containing these soluble acids, had, when warmed, a distinct odour of butyric acid. Any attempt at the estimation of the proportion, on such a small quantity, would of course have been useless.

The insoluble fatty acids weighed about 86 per cent.

The figures, as far as it has been possible to obtain them, indicate that this sample has not undergone any notable decomposition during 25 centuries. This stability must, in all probability, be attributed to the fact of the butter having been melted and sealed, so as to secure it against atmospheric influences. In this respect it presents a marked contrast to the bog-butter previously referred to.

Mr. Hehner said he had a lingering doubt in his mind as to how it could possibly be proved that it was ever butter. It might have been some other animal substance; it looked like chalk now, but it might have been cheese, which under certain circumstances is transformed into fat.

Dr. Bartlett thought they had never had a specimen of ancient cheese presented to their notice, but in fragments of ancient cheese they found something very different to that then before them. The oldest cheese he was acquainted with was some that was contained in a screwed up flask, recovered from the *Royal George*. It had dried up into a perfectly solid mass, containing only a small amount of fat. He thought the large amount of fatty acids would lead them to suppose that that was not originally cheese.

The appearance of adipocere, such as is found in coffins, is not at all dissimilar to that. Adipocere is said to be produced by the action of running water on animal flesh.

Mr. Blyth said that putting on one side the chemical evidence, they certainly had marks very similar to what a stave would make, and besides that the presence of hair. He thought the evidence pointed to it being butter rather than anything else. With regard to the holes he suggested that they might have been made by some boring insect or beetle.

Mr. Angell said the only thing which struck him with regard to the examination was the amount of the curd, which was rather indicative to his mind of fatty degeneration.

Mr. Wigner, in reply, said that as to the older sample, the alabaster vase was recently opened in the presence of two or three gentlemen. Mr. Church took this sample and it has not left our charge since. Its age, therefore, was undoubtedly what it was represented to be.

With regard to the sample of bog-butter, it had been suggested that it was cheese, but those who had studied the subject were aware that cheese had been repeatedly found in these Irish bogs, and that it was not found in cases or tubs as the butter is, but invariably showed signs of having been wrapped in a kind of canvas or cloth, the characteristics and form of cheese being to a great extent preserved; neither would it be reasonable to expect such perfect conversion of cheese into fatty acids. The possibility of its being adipocere was negatived by the analysis. Adipocere contained much lime and phosphoric acid, and the sample was almost absolutely free from these constituents. Dripping, or some other animal fat, might have undergone a similar decomposition to that of the present sample, but there was nothing to indicate that the theory of dripping was more probable than that of butter. On the contrary, the results of the microscopical examination, and the percentage of true casein found, pointed distinctly to butter.

LAW REPORTS.

THE NORFOLK BAKING POWDER CASE.

Alum in Baking Powder.—The Conviction Quashed with Costs.

WARREN *v.* PHILLIPS (inspector). This was an appeal at the Cambridge Quarter Sessions, before the Recorder, J. R. Bulwer, Esq.. Q.C., M.P., against a decision of the magistrates who convicted Messrs. Warren of selling a certain article of food, baking powder, mixed with a certain ingredient, alum, so as to be injurious to health.*

The appellants were represented by Mr. T. C. Blofeld and Mr. Horace Browne; while Mr. Cockerell and Mr. Turner appeared for the respondent.

Mr. Cockerell opened the case for the respondent. The proceedings before the magistrates were, he said, taken under the 3rd section of the Sale of Food and Drugs Act, 1875, for selling an article of food, namely, baking powder, mixed with an ingredient that rendered it injurious to health. The third section made it an offence to "mix, colour, stain, or powder any article of food with any ingredient or material so as to render the article injurious to health, with the intent that the same may be sold in that state." The interpretation clause described "food" as every article used for food or drink by man other than drugs or water. The facts under which the conviction in the baking powder case took place were these:—Some proceedings having been taken against a baker for the adulteration of certain buns sold by him, and it being alleged by him in defence or mitigation that the adulteration was caused by the use of this Norfolk Baking Powder, it was thought desirable and necessary to test the validity of the sale of that powder by having an analysis made of it as sold by the dealers in Cambridge, and that analysis led to these proceedings being taken; but although Messrs. Warren were the nominal defendants, yet substantially the real defendants then and the real appellants now were the manufacturers of this powder, Messrs. Smith & Sons, of Magdalen Street, Norwich, who were in a very large way of business. He might say, too, that there were several other gentlemen in the same way of business in Norwich, who took an interest in this matter, and they had combined together to test the question whether this baking powder did contain any ingredient which was injurious to health so as to bring it within the provisions of the Act of Parliament. A quantity of the powder having been purchased it was put before the Public Analyst, whose certificate he handed in to the Recorder.

Mr. Blofeld said the appellants would not dispute the analysis being approximately correct, but he would hand up to the Recorder the actual ingredients. There was only one thing omitted. Learned counsel then handed up the analysis to the Recorder, observing that he did not wish it to be made public.

Mr. Cockerell then proceeded with his address, and said that speaking roughly the quantity of alum contained in the powder was about one-third of the whole, and the question for the Recorder to decide was whether that quantity made the powder injurious to health.

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* *See* THE ANALYST, vol. iv., p. 231.

The Recorder pointed out that in one of the analyses the alum was described as crystallized potash alum, and in the other as burnt alum.—Mr. Cockerell said burnt alum was double the strength of the other.

Mr. Blofeld : The Public Analyst here made a little mistake before the magistrates in saying that it was burnt alum instead of crystallized.

Mr. Cockerell then drew attention to the directions for using the powder—one teaspoonful to a pound of flour, and which especially recommended it to housekeepers for use in bread, while for Norfolk dumplings, it was the only means of securing lightness and digestibility; its use ensured exactly the contrary, since it rendered bread indigestible by hardening the gluten of the flour, which produced constipation and other ills.

The Recorder said the conviction set forth that the appellants, "George and Edward Warren, did sell a certain *article of food*, to wit, baking powder, mixed mith a certain ingredient, to wit, alum, so as render such article injurious to health." Therefore they had first to ascertain what was the *food* that was mixed with the alum? The charge was "*food*, to wit, *baking powder*, mixed with a certain ingredient, to wit, alum." Therefore the "article of food" was the baking powder.

Mr. Cockerell : That is my contention.

The Recorder : But the baking powder, from the analysis you have handed to me, is not complete *without* the alum. The alum is a part of the baking powder. First of all before you get the thing that is mixed you must get the *food*.

Mr. Cockerell : The food is the baking powder. I say alum is no part of the baking powder necessarily. Baking powder ought to contain no alum.

The Recorder : But you have got the powder that the man sells.

Mr. Cockerell : It is sold as baking powder.

The Recorder : What of that? Suppose for argument that I sell chalk and arsenic mixed together and advertise it as baking powder, is it to be said that I adulterate an "article of food," chalk, by the arsenic, or the arsenic by the chalk? Let us go by steps. Where is your article of food that is adulterated? The article of food becomes extinct by the adulteration. Where is your article of food without the alum? Bicarbonate of soda and other matters. Is bicarbonate of soda an article of food?

Mr. Cockerell : I say that baking powder is an article of food, commonly sold by these people and by various others, but alum is not a necessary part of that powder, which ought not to contain any.

The Recorder : Is there anything known as baking powder?—Mr. Cockerell : Oh, yes.

The Recorder : If you will give me evidence of that I shall be glad. I never heard of baking powder beyond what chemists advertise as such, any more than I know of aperient draughts which may contain no one knows what. Is there such a thing known as baking powder?—Mr. Cockerell : Yes, known to the public.

The Recorder : I mean as an article of food.—Mr. Cockerell : Of course people don't eat baking powder. Everybody knows what it ought to be.

The Recorder : You can only know what baking powder is by analysing it. Suppose A sells a particular compound and calls it baking powder, which is to produce certain effects if used in cookery; B makes up a certain other mixture and calls that baking powder; while C, D, and so on, proceed in like manner. They are all called baking powder.

Mr. Cockerell asked if the word "mix" did not bring the baking powder under the section.

The Recorder : The Act says "No person shall mix *any article of food*." You must first of all get your food.

Mr. Cockerell : I say the alum ought not to be there, and that the powder is mixed improperly.

The Recorder : Then you are driven to the other alternative—that the bi-carbonate of soda and the rest of the ingredients are an article of food.—Mr. Cockerell : When compounded as baking powder.

The Recorder : Suppose I go to a druggist's shop and ask for an aperient draught, and it is composed of rhubarb and magnesia, is the chemist to be convicted for adulterating rhubarb with magnesia, or magnesia with rhubarb?—Mr. Cockerell : You get what you want.

The Recorder : No, I don't ; I ask for an aperient draught. If the inspector had gone and asked for bi-carbonate of soda, and they had given him the soda mingled with crystallised potash alum, there would have been a case directly.—Mr. Cockerell said the effect of the learned Recorder's construction of the Act would make it inoperative altogether.

The Recorder : No; if a baker chooses to mix some noxious compound—mind, I don't say this is—with his bread and sells it he is liable. I am only calling attention to the matter just to have my mind clear upon it.—Mr. Cockerell said no question of this kind had ever been raised. We treat baking *powder* as an article of food.

The Recorder: Then I shall want you to tell me what baking powder is.—Mr. Cockerell: My medical witnesses will tell you what this particular baking powder is, and what baking powder ought to be without alum, but that is put in because it is cheaper. It is admitted that the powder is to be put into articles of food. In the course of further argument the Recorder said even if the powder became injurious to health when put into food it was not an article of food.

Mr. Cockerell also said that the rice flour was an article of food.

The Recorder: I don't know what evidence will be given upon it, but I should have thought the rice was only a medium or padding.—Mr. Blofeld said that was so.

Mr. Cockerell said he had asserted his contention, and he did not know whether the Recorder intended to express his opinion on the point.

The Recorder said he was hardly in a position to do so yet without some evidence upon it.

Mr. Blofeld said the point was if the rice-flour was an article of food whether it was rendered injurious to health by the alum.—Mr. Cockerell then called

Mr. J. W. Knights, Public Analyst for the borough and county of Cambridge, F.C.S., &c., who deposed that from the experiments he had made with the baking powder he was of opinion that when mixed with the flour it rendered the gluten of the flour and the soluble phosphate contained in the flour insoluble. When a teaspoonful of the powder was mixed with a pound of flour and water added, it would liberate the carbonate acid gas and render the soluble phosphates contained in the flour insoluble, by forming phosphate of alumina, which is insoluble. It would render the phosphoric acid insoluble. He believed an adult in health required 50 grains of phosphoric acid per day. Phosphoric acid was derived from bread and other articles of consumption; in some cases chiefly from bread. Bread made with this powder, as directed, would give less soluble phosphoric acid than there should be by 7-10ths. 7-10ths of the phosphoric acid would be rendered unavailable, and he should presume the bread would be less nutritious. With children the effect would be the same, but to a greater degree. It would impair digestion.

Cross-examined by Mr. Blofeld: That is a chemical opinion that I have formed.

With regard to the powder rendering the gluten of the flour less soluble is that mere opinion formed by your experiments in your laboratory?—Yes.

Have you actually made bread?—Yes.

But the hardening of the gluten of which you speak is not the result of anything apparent to the eye, but your opinion formed upon your experiments?—It is actually apparent to the eye. I have not my laboratory here or I could show you experiments, but it takes time to make them.

As to rendering the phosphoric acid insoluble, what authority have you for stating that a man in health requires 50 grains of phosphoric acid in the 24 hours?—I saw it so stated in a medical work—"Parke's Treatise on Practical Hygiene," I think. That is the only authority I can remember. I have looked at no others.

Are you aware that the body rejects as much as from 75 to 100 grains of phosphoric acid per day?—It rejects a very large quantity.

May I take it that that which the body rejects is what the body does not require to assimilate?—Certainly, but I am not a medical man. When the bicarbonate of soda and alum are mixed with water effervescence takes place and carbonic acid gas is given off. The residuum from the alum is hydrate of alumina, that from the soda is sodic sulphate or sulphate of soda.

So that when the bread is made with this powder there is no alum in it and no bicarbonate of soda; they both cease to exist?—Yes.

By the Recorder: This change takes place when water is added. In the presence of flour the case is somewhat different. The bicarbonate of soda and the alum effervesce in the dough, and there is a residuum from each, but the hydrate would become phosphate.

By Mr. Blofeld: When mixed with the flour and moisture I should say the phosphate of alumina is formed immediately, and not hydrate first, but I cannot say that positively. It is necessary, to change the hydrate of alumina into phosphate, that there should be actual contact between the hydrate and the phosphoric acid in the flour.

How is the little hydrate of alumina there would be in a 1lb. loaf to come into contact with all the grains of phosphoric acid to be found in the dough, so as to form it into phosphate of alumina?—Because it is mixed in a dry state. Phosphate of alumina is perfectly well known to be insoluble in water. I believe phosphate of alumina is not soluble in the gastric juices, but that is a question for a physiologist and not a chemist. It is perfectly insoluble in acetic acid. It is soluble in hydrochloric acid, and the gastric juice is suppose to contain that. I do not believe the gastric juice is practically a weak solution of hydrochloric acid. I have heard that no hydrochloric acid exists in the gastric juice in a free state. I forget where I read that, but it was not in a newspaper. I have no authority for the assertion that the gastric juice is not equivalent to hydrochloric acid. The injurious effect of this baking powder does not depend upon the assertion that phosphate of alumina is insoluble in the stomach.

If it is soluble in the stomach what harm could it do?—It would probably have an astringent effect.

You would not undertake to say that positively, would you?—No, I am not a doctor.

The Recorder: Does a minute quantity of alum in bread make it injurious to health; I have heard that it rather improves it?—I think it is no improvement. However small the quantity there is a corresponding quantity of phosphoric acid rendered insoluble.

By Mr. Blofeld: I cannot cite any case where injury has been done to health by the use of a small quantity of alum. Alum is very little prescribed except for use externally and as a gargle.

Mr. Blofeld then produced two small boxes containing gluten, one of which he said contained no phosphate, the other had in it five times as much as could possibly be found in any bread made with this baking powder. He handed the two to witness and asked him if he could see any difference between the two. Witness: I can see no difference, but I could tell the difference in my laboratory. The hardening of the gluten would not be perceptible to the touch or to the eye without experiments, and I could not tell which box contains the phosphate of alumina and which does not.

By the Recorder: Bakers use alum to make bread look nice. To make bread rise, cream of tartar is equally efficacious with alum and is frequently used. The rice flour in this powder is, I believe, merely added to keep the composition dry and in a friable state.

It is no part of the baking powder?—It keeps the powder in a powdery state, and so far as the effects of the bicarbonate of soda and the alum are concerned it is not necessary that it should be there.

Mr. Blofeld: All articles of food contain phosphoric acid do they not?—A great many do, such as milk, beer, meat, fish, &c., almost all practically. A pound of flour contains about 12 grains of phosphoric acid, and a pound of flour would make up into about 1½-lb. of bread. Have not ascertained how much phosphoric acid there would be in 1½-lb. of bread, but it certainly would not be lost in the baking; it would not volatilise.

Mr. Blofeld: I shall show you that the proportion would be very much less.—In that case it would be only as phosphate of lime. In Cambridge water there is a good deal of lime but not much magnesia. The bread here must be made up with water containing lime. Phosphoric acid has an affinity for the lime, that is, assuming the absence of the baking powder. I do not think the phosphoric acid in the bread would combine with the lime first and leave the alumina till all the lime had been used up. I ascertained how much phosphoric acid there was in a pound of flour by analysis, and I found it to vary from 10 to 12 grains, I think. I speak doubtfully as I have not calculated the average.

The Recorder: How long would it take to kill a man if he ate an ordinary quantity of bread daily made with this baking powder?—A man in health and with good digestion would possibly live some time.

The Recorder: Have you ever heard an instance of anybody having a fit of indigestion from eating bread made with this powder and clearly traceable to it?—No. I have come into contact with no case, but I should judge, from my chemical knowledge, that indigestion would follow. The effect of either hydrate or phosphate of alumina would be to harden the gluten. Baking powder can be made with many other ingredients besides bicarbonate of soda and alum.

As a chemist, in how many ways could you make baking powder?—Four or five ways probably. By combining an alkali with an acid, baking powder is formed. Only three or four ways would be unobjectionable.

There is no such thing as baking powder, is there, beyond the fact that a man fancies the name and gives it to what he makes?—There is no recognized formula for making baking powder.

You might make it as you would make an aperient draught?—Yes; it is not known in the British Pharmacopœia. It is what men choose to call it. It might be termed "Substitute for yeast powder," or "Norfolk dumpling powder."

Mr. Matthew Moncrieff Patteson Muir, Prælector of Chemistry in Caius College, Cambridge, then gave the effect of an experiment that he had made with a mixture like that contained in the baking powder with phosphate of soda instead of flour, and said he found insoluble phosphate of alumina. He also made an experiment with half-a-pound of flour free from alum, treated it with water, and found the water contained a large quantity of phosphoric acid. He also mixed half-a-teaspoonful of the baking powder with half-a-pound of flour, treated it as before, and found the water contained very small quantities of phosphoric acid. Witness was about to give the result of experiments made with bread in which was mixed the Norfolk baking powder and bread made with another baking powder, but Mr. Blofeld objected to a comparison between baking powders. Witness then described an experiment he had made with the Norfolk baking powder when made into bread according to directions, and said he found about 1½ grains of soluble phosphoric acid to the lb. of flour used in the bread. In an experiment he had made with yeast bread he found about 3 grains of soluble phosphoric acid to the half-lb. of flour, or, in round numbers, four times the quantity. He tested the bread with hydrochloric acid of 2-10ths per cent. strength at a temperature of 100° Fahr., with the results he had given. The reason for taking that particular kind of hydrochloric acid was because that was taken as the average strength of the hydrochloric acid in the gastric juice. He then stated that he composed a mixture like the baking powder prepared, a quantity of gluten from flour, digested it with half a litre of 2-10ths per cent. strength hydrochloric acid for 50 hours, and found that there was 20 per cent. less of the gluten dissolved than there was in a similar quantity heated without alum, soda, &c. Then he made a further solution with a mixture of dextrine—a modified form of starch which might be taken to represent the starchy matter in flour—with water, and added a solution of alum and a solution of phosphate of soda. The phosphate of alumina which was precipitated carried with it the greater portion of the previously soluble dextrine. In experimenting with a loaf made of the same powder he determined the quantity of phosphate of alumina existing was 25 grains per 4-lb. loaf; that was about 5 grains to the ½-lb. loaf. Witness then corrected himself, and said he made a mistake in his calculation, he should have said about 3·03 in the ½-lb. loaf. From these experiments he should say the effect of this baking powder made into bread was that the alum in powder was wholly decomposed, with the production of phosphate of alumina and sulphate of soda. This phosphate of alumina, he added, rendered the gluten and the dextrine less soft.

By the Recorder: I could form no idea of the effect of a man eating an ordinary quantity of bread for a year made with this baking powder because I have no medical knowledge.

Cross-examined: The soluble phosphoric acid is present in the flour in the form either of phosphate of potash or phosphate of soda. The presence of an alkali in the bread would affect the colour and make it brown or a yellowish brown if in a large quantity. The presence of 6 grains of alkali in a 4-lb. loaf would probably give it a yellow tint. I should expect to find an objectionable discolouration from the presence of 5 or 6 grains in a 4-lb. loaf. Blyth in his "Manual of Chemistry" is my authority for giving the average amount of phosphoric acid in a pound of flour as 12 grains. I should be surprised to find that there are 28 grains. Perhaps you are dealing with phosphate of potash and I am dealing with phosphoric acid, known to chemists as P2. O5., but if we mean the same thing I should be surprised to find that number of grains. Supposing phosphate of soda and alum in bread in an uncombined state the treatment by water would effect their combination and produce the phosphate of alumina.

Therefore your very experiment may have produced phosphate of alumina?—Yes. If a man eats ¾-lb. of baking powder bread a day he would get into his system—if laboratory experiments are correct—2¼ grains less of phosphoric acid than he would by the use of other bread. I know the system ejects phosphoric acid to a certain extent, but I can't give figures. I did not know it was more than 50 grains. On the other side of the coat of the stomach there would be blood, which is alkaline, with the wall and membrane between the two.

That being the case would not the phosphoric acid filter out of the phosphate of alumina through the intervening wall into and combine with the alkaline blood in the system?—That is a question that could only be determined by direct experiment. I would not be surprised to have either result. I think one may infer that the gastric juices are equivalent to a weak solution of hydrochloric acid. I made my experiments upon that assumption. The dextrine I used I obtained from chemical dealers. There are as many as ten kinds of dextrine. It is made from flour. There are dextrines altogether pure that vary in their reactions.

In re-examination by Mr. Cockerell, witness said that he did not admit the correctness of the supposition that if the phosphate of soda and the alum and bread were in an uncombined state his experiment might have produced phosphate of alumina; the phosphate of alumina was in the bread previous to his experiment.

By the Recorder: I know of no formula for the term baking powder. Baking powders do not produce fermentation, but yeast does. Baking powder produces carbonic acid gas without fermentation. I could make perhaps a dozen baking powders wholesome or unwholesome, and might make two or three that were wholesome. The powder would be equally efficacious without the ground rice.

Mr. Blofeld said the manufacturer informed him that the object of introducing the ground rice was to keep dry the alum and the bicarbonate of soda, both of which might have some moisture about them.

Witness added he would think the mixture would be improved by the ground rice. Other things might be found, but ground rice was quite as good as anything else.

Dr. J. B. Bradbury, Linacre lecturer in physic at St. John's College, F.R.C.P., and one of the physicians at Addenbrooke's Hospital, deposed that from what he had heard from the experiments of the last two witnesses, he should say the effect of the powder used in bread would be to rob the dietary of a certain amount of soluble phosphate which was essentially necessary to nutrition. He agreed with the other witnesses as to the amount of phosphoric acid required for a healthy adult every 24 hours, and as to the amount contained in a pound of flour. In answer to the Recorder, the witness said that people suffered from indigestion who did not eat bread. They got their phosphoric acid from meat, milk, &c. Baking powder produced the same effect as aërating the bread, which was done by forcing carbonic acid into the dough by machinery.

Bread made with yeast disagrees with some people. Practically speaking, is there any fault to be found with bread made with this baking powder?—I should say people might partake of it occasionally with impunity, but if they were to eat it constantly, and especially if they were chiefly to live upon it, it would have a deleterious effect. It would produce indigestion even in a man who led a regular life.

How long has this baking powder been in use?

Mr. Blofeld: Thirty-nine years, and many millions must have eaten bread, &c., made with it.

Dr. Bradbury: It leaves no record how many people have died. There are many diseases one cannot fathom. Stone is very common in Norfolk, and it is not very easy to fathom the cause of it.

The Recorder: Baking powder does not produce stone, does it?—Witness: Indigestion does.

The Recorder: I should have thought the water of Cambridge would have produced more.

By Mr. Cockerell: The use of the powder in bread would have a greater effect upon invalids and children, and taken constantly it is injurious to health in my opinion.

Cross-examination: Many suffer from eating bread made with yeast. People get bad yeast sometimes. Some people buy what is called German yeast, but that is not because the ordinary yeast is scarce, but because the other is more convenient to obtain.

Mr. Blofeld then drew the attention of the witness to Mr. Sutton, and asked if he looked in moderately good health.—Witness: Fairly good.

The Recorder: You had better ask Mr. Sutton now what he thinks of Dr. Bradbury.

Mr. Blofeld said Mr. Sutton stated before the magistrates that he had eaten things made with this baking powder for many years.—Mr. Sutton: And I never suffered from indigestion.

Mr. Cockerell: Mr. Sutton has sovereign remedies for that.

Cross-examination continued: A man eating bread made with this baking powder would be the worse for it at the end of five years.

Is bread made with this baking powder anything like so indigestible as new cheese?—New cheese would suit one person who would not suffer at all, while others would suffer.

The Recorder: Ask him if it is as indigestible as plum-pudding.

Witness: Plum-pudding is not made with baking powder, but it is indigestible.

Mr. Blofeld: Is bread made with this baking powder one-hundredth part as indigestible as new cheese?—I think it would be one-hundredth part.

A little more?—A little more.

Do agricultural labourers who eat a great deal of cheese often suffer?—They have many complaints. I wouldn't put a stop to making cheese, but I would put a stop to eating it.

Your evidence with respect to this baking powder is founded on the assumption that the phosphate of alumina is insoluble in the stomach?—Not altogether, but chiefly.

And if I satisfy you that the phosphates are not insoluble in the stomach your opinion would be altered or modified?—It would.

In answer to questions by the Recorder, witness said that 50 grains of phosphoric acid were excreted by a healthy man in 24 hours, and these had to be supplied, and that if a man were deprived of the component parts of the phosphoric acid he would be injured to that extent.

Dr. Paget, Regius Professor of Physic in the University of Cambridge, F.R.S., F.R.C.P., &c., deposed that having heard the evidence of Messrs. Knights and Muir, and assuming that their experiments were correct, the effect of a person in ordinary health eating an ordinary quantity of bread made with this baking powder would be that in the course of time digestion would be impaired. Going on the experiments of Mr. Muir, that it has the effect of rendering less soluble the dextrine and the gluten of the bread, he should certainly be of opinion that it would render them less digestible, and so far injurious to health. In children the effect would be more marked, and with persons who had weak stomachs and were troubled with dyspepsia or feeble digestion it would be positively injurious. Questioned on the amount of phosphoric acid required to be taken into the system by a person in good health every 24 hours, the professor stated that to keep a person in health he must take as much of an ingredient, if it were a constituent of the body, as went out of him, and assuming it to be correct that 50 grains of phosphoric acid went out daily, he required to have a like amount introduced.

Mr. Blofeld: Do you imagine that the loss of 2½ grains of phosphoric acid through eating 1½-lb. of bread would be injurious to any man's health?—Not if a man got other food. If a man were to get 2½ grains of phosphoric acid less every day than passed out of him it would very soon be a serious matter.

If I neutralise 2½ grains of phosphoric acid which I should otherwise get should I be one whit the worse off than before?—Probably not; probably you take more phosphoric acid every day than is good for you.

Mr. Blofeld: I hope you confine your remarks to phosphoric acid. But take anyone else in this court; would any man eating this bread be sensibly damaged?—I hope not, because I should hope everybody gets as much food as would compensate him for the loss of the phosphoric acid he requires. If he gets meat, cheese, eggs, milk, and other things in fair quantities the loss of that small amount of phosphoric acid would be of very small moment indeed. The articles I have mentioned contain phosphoric acid, and fish and cheese in very large quantities, vegetables in less quantity. At this moment I cannot think of any article of food that does not contain phosphoric acid. My opinion that bread made with this baking powder is injurious is based upon the fact spoken to by Mr. Muir that it renders less soluble the gluten and dextrine of the flour.

Not as diminishing phosphoric acid?—I said nothing about that. I think it is a disadvantage that it should harden the dextrine. I should not say it was injurious to health except in the case of those who had to live on bread alone.

Baking or roasting meat makes it less digestible than if it were boiled?—Yes, provided it be not boiled too much. Roast goose would no doubt be injurious to the health of a dyspeptic person. If you were to eat it daily during the year you would find evil effects from it.

The Recorder: Would you say in the words of the Act of Parliament that bread made with baking powder was an article of food injurious to health?—I would not venture to say it except in the case of persons of weak digestion. We have not sufficient exact experience I think in regard to persons in ordinary good health to give an opinion on the matter. There is experience of alum in bread being injurious to health.

That would depend upon the quantity in the bread?—The larger the quantity the worse the effects.

Is alum always injurious?—Taken repeatedly I should say it would be. I should say if any practical physician were asked if he would allow any person to take even a few grains every day of his life for a time he would not only advise to the contrary, but would say probably it would cause some disorder of the stomach before long. It is scarcely ever prescribed except externally.

Mr. Blofeld then addressed the Court on behalf of the appellants, and pointed out the importance of this case to a large trade which had been carried on in Norwich, in other parts of the kingdom, and in America, for nearly 40 years. This alum baking powder had been in use almost as many years as he had lived, and not a single objection had been made to it by any human being during that time till proceedings were taken at Cambridge; it was reserved for Mr. Knights, the analyst employed by the Corporation of Cambridge, to discover what had remained a secret to generations of medical men and analytical chemists. Millions upon millions must have used it and there had been no complaint, and he defied his learned friend, Mr. Cockerell, to produce any single human being on the face of the earth to whom the use of this powder had given indigestion. Such a case could not be found. The legal points arising in this case he could not have put so well as the learned Recorder had done, but he urged first that baking powder was not an article of food, and that it had not been proved that anything had been mixed with the baking powder to adulterate it because the baking powder was the thing itself. Yeast if partaken of would be injurious to health, but he imagined that no one would contend that the man who sold yeast would be liable to conviction under this Act. Probably if a man took a pint of yeast he would blow up. Yeast was used in the preparation of drink, but it was not an article of food. And so baking powder was not an article of food—it was used in the preparation of food, but in the bread it ceased to exist; it became something else, a small residuum and the sulphate of soda. As an analagous case the learned counsel referred to the gasogene in which two powders were placed, water applied, and the powders vanished, while the water became aërated. The powders were not used as articles of drink, but for evolving gas, after which they ceased altogether. It would be quite as reasonable to summon Mr. Deck, the chemist, of Cambridge, for selling these powders, the one in a blue and the other in a white paper, that produced this aërated water, as it was to charge Messrs. Smith & Son, of Norwich, with selling baking powder as an article of food. He could suggest many other things, such as flavouring of bitter almonds which was more or less a poison. Here was an article that was injurious to health, and it was mixed in jellies, but was Mr. Litchfield, of Cambridge, to be proceeded against because he flavoured jellies with bitter almonds? What the respondents had to show was that the article of which they complained was rendered injurious to health by the mixture of alum. The baking powder——

The Recorder: Do not call it baking powder; call it the constituents of it. There is no such thing as baking powder. There must be something analogous to the alum; we have no powder without the alum. You have got according to this an answer to the case, but in deference to others, I have occupied more than five hours to investigate this case, and if the parties wish I will take it further, but, as I said at starting, it appears to me you must first of all get an article of food which is to be so mixed with an ingredient as to make it unwholesome and injurious to health. The baking powder is not baking powder without the alum.

Mr. Cockerell said he could only repeat what he had said at the commencement of the case.

The Recorder added that he was not speaking in derogation of the safety of the public, but he had to administer the law, and it must be remembered that this was a penal law which was to be construed strictly, and not to be extended to cases which the Legislature had not in contemplation. He then took the points raised by Mr. Blofeld as follows:—That the powder, including all these ingredients, is not an article of food; if an article of food, taking all the ingredients together, nothing has been mixed with it; that the ingredients when mixed and used for food cease to exist; that baking powder without the alum is not an article of food.

Mr. Blofeld further argued that the meaning of the Act was that anything injurious to health should be actively injurious, and that the presence of something that merely robbed an article of food of some small quantity of nutrition would not be considered injurious to health, and this baking powder, he contended, used according to the directions, was not injurious to health. The object of its use in bread was to evolve carbonic gas and make the bread light; in ordinary this was done by yeast, and in aërated bread the gas was forced in by machinery. All baking powders were compounded on the principle of combining an alkali with an acid. For instance, Borwick's baking powder was tartaric acid and bicarbonate of soda; water was added, and effervescence took place, and all the original constituents practically vanished and left something else. The objection to powder containing tartaric acid was that the effervescence was almost instantaneous, whereas superiority was claimed for the Norfolk baking powder because the effervescence was much slower. The cream of tartar and bicarbonate of soda were employed, and there was a way of making powder with hydrochloric or muriatic acid, which was a caustic and corrosive poison, and of course it would be a most deleterious thing to get into the stomach. But as soon as it combined with the bicarbonate of soda, the hydrochloric acid vanished, and what was left was common salt, which was perfectly innocuous. In the Norfolk baking powder the alum was used, and as soon as alum was combined with bicarbonate of soda and water was applied effervescence took place, the alum and soda vanished, leaving alumina and sulphate of sodium. When one looked at the dictionary, one found alumina to be an inert earthy matter, the chief constituent of clay, and a constituent of all cereals. So that in all breads alumina would be found, whether alum was used or not. Learned counsel then produced a tube containing six grains of alumina, and said that one of his witnesses, Dr. Beverley, with a view of testing its effects, had swallowed 20 grains of it. There was no effect, and learned counsel had no doubt he would take 20 grains a-day for a long time.

The Recorder: The doctor would carefully prepare himself with an antidote probably.

Mr. Blofeld proceeded to say that in Pereira's great medical work it was recommended that alum should be administered to children suffering from looseness of the bowels and flatulency in doses of from 60 to 120 grains during the 24 hours. Learned counsel was not there to defend the use of alum in bread. It was used in bread to enable the bread to absorb more water, and so increase the weight, while it gave a good colour to bad flour, and so enabled the baker to perpetrate a fraud. Whether alum was injurious to health was an open question, but he was well warranted in saying that there was no recorded case in the world of poisoning by alum, let the quantity taken be ever so great, and he questioned whether there was any case of alum being injurious to health in any way. It was an astringent they knew, but there was no case on record of its being injurious. People thought the alum in this powder went into the bread, but this was a mistake, for in the bread alum ceased to exist, and so far as using the powder to make bread white was concerned, if too much of it was used the bread would be discoloured, and it would make good flour look bad. Then as to what was left after the alum *had come in* contact with the potash and bicarbonate of soda, the appellants contended that it was hydrate of alumina and not phosphate, and they had procured the opinion of the most eminent men in the kingdom on the point. Even supposing that phosphate of alumina was found, which he did not admit, then he should show that it was not insoluble in the gastric juice. He should produce an experiment which showed that the alumina was perfectly soluble in an acid like that composing the gastric juice, but it was not only soluble in the gastric juice, but in a variety of other things. His witnesses had paid the greatest attention to the evidence given by the skilled witnesses called on the other side, but they would undertake to say that not the smallest harm in the world could be done to any human being by the use of this baking powder.—Learned counsel then called

Mr. Fras. Sutton, F.C.S., F.C.I., Public Analyst for Norfolk and other places, consulting chemist to the Norfolk Chamber of Agriculture, and author of several analytical works. He deposed that when the baking powder was mixed with the alum it became hydrate of alumina. He did not believe that in bread made with this baking powder phosphate of alumina was found, and it was a very difficult thing to prove that it was. If it were so formed it was believed that it would be soluble in the gastric juice.

Mr. Blofeld: Is it what you would call a strong or a weak chemical combination?—Weak, which means that it is not hard to dissolve or to decompose. Many fluids would decompose it.

It is said that the alumina found in bread neutralises a certain amount of phosphoric acid in the bread; what do you say to that?—It may possibly do so, some portion of it. Supposing it contains phosphate of alumina the fluids of the stomach decompose that phosphate of alumina, and the result would be that the person would be none the worse for it. I have tested bread made with baking powder and bread made with yeast to ascertain the amount of phosphoric acid in each. I made two loaves, or had them made under my superintendence, one with yeast and the other with the Norfolk baking powder. The yeast bread on treatment with cold distilled water gave me 3·04 grains of phosphoric acid dissolved by the water. These were 4lb. loaves. The bread made with baking powder gave me 2·32 grains, being a difference of 72-100ths of a grain in a 4lb. loaf, or 17½-100ths of a grain in a 1lb. loaf.

It is said that the use of baking powder hardens the gluten and the dextrine?—My opinion is that it has no such effect in bread. I have tried an experiment to see if it did by mixing phosphate of alumina with gluten, but I have made no experiment with dextrine. I do not agree that phosphate of alumina renders the gluten less soluble from the experiments I have made. My experiment was to mix the phosphate with the gluten in a very large excess. In one of the boxes produced I have got gluten without phosphate, and in the other the same quantity of gluten with phosphate added in five times the proportion that would be found in the baking powder, and the condition is not altered in the least.

The Recorder: Have you tested its solubility?—No, I did not think it was fair to make such a test with hydrochloric acid. It is not soluble in water, but it is soluble in the juices of the stomach.

By Mr. Blofeld: Hydrochloric acid has not got the salivary fluids or the pepsine in it. Hydrochloric acid is only one of the ingredients, and is but a feeble reproduction of the gastric juice. It is like the gastric juice, leaving out the most important parts. The salivary fluids are particularly necessary for the digestion of all kinds of food, like bread and so on.

You would not be surprised to find that Mr. Muir's experiments were correct, and yet that if the phosphate got into the gastric juice it would do no harm?—Not at all. I may also say that a very high authority, Mitscherlich, of Berlin, states that compounds of gluten with alumina are perfectly soluble in the juices of the stomach.

Will you tell us the result of the experiment you have recently made with two pigs?—Two healthy pigs, of about 5 st. weight each, were purchased and placed in a pen with a boarded floor to prevent them getting earth, which contains alumina. For eight clear days they were fed upon bread made with this Norfolk baking powder in proper proportions mixed up with warm water to a very soft sloppy consistence so as to give the best chance for the formation of phosphate of alumina. They consumed in the eight days 91lbs. of flour, and at the end of 28 days I went and saw them killed.

The Recorder: They did not die as the result of the treatment?—Oh no, sir. The pigs had thriven well during that time and their internal appearances were perfectly healthy, as was admitted by the butcher as well as myself. I had removed the stomach and the whole of the bowels, and had them tied up and sent to my laboratory where I examined them. I opened one stomach where the pigs were killed, and they had the mixture of the powder then in a sloppy condition. I removed separately the contents of the upper portion of the bowels, the second stomach, and also the contents of the lower bowels, or rectum. I took equal portions from the two sets of bowels for each pig, keeping the two uppers separate, and the two lowers separate. I then dried down these separate portions of fœces in platinum vessels, and then burned off the organic matter, with the addition of small quantities of potash to prevent the reduction of the phosphoric acid; the result would be the ash, in fact, of the fœces, and would contain the whole of the phosphoric acid and other mineral matters present. I then made an analysis of the ash to find the ratio between the alumina and the phosphoric acid. The analysis of the upper bowels showed phosphoric acid 2·24 per cent., oxide of iron 1·08, alumina 3·68, lime 0·9, magnesia 0·4, sulphuric acid 0·274, the remainder was unconsumed carbon, alkalis, &c. In the case of the lower bowels the proportions were phosphoric acid 2·43, oxide of iron 1·18, alumina 4·91, lime 1·13, magnesia 0·54, sulphuric acid ·343. On the assumption that the whole of the phosphoric acid is combined with the alumina, the excess of alumina in the upper portion of the bowel was 2·07 per cent., and in the case of the lower bowel 3·15 per cent. But it is an open question whether the whole of the phosphoric acid is combined with the alumina, because the other things present, which are stronger bases, keep it entirely to itself. The inference to be drawn from the experiment is that the gastric juice in the stomach takes all the phosphoric acid it requires, and if the phosphate of alumina is there at all the gastric juices absorb the phosphoric acid out of it if it is required, leaving the hydrate of alumina in the bowel to be rejected with the fœces. That experiment is a guide to what goes on in the human stomach, and I look upon it as an analogous case.

By Mr. Cockerell: Is alum in bread injurious?—*Per se*, I do not think it should be allowed, because it opens up a way for fraud. Apart from that I do not think a little of it used would be injurious. I do not think 40 grains in a 4-lb. loaf would be injurious. That is my private opinion; I am not giving a medical opinion on that point. Chloride of alumina would be objectionable in a large quantity.

The Recorder: I suppose you might evolve poisonous things out of a mutton chop?—Oh, yes.

By Mr. Cockerell: Mr. Muir produced his phosphate of alumina in conjunction with the gluten; mine was produced the same way as it would be in the bread. I extracted the gluten from the flour in a pure state. The effect of hardening the gluten in any way would be to make it tough like leather. It is of no use my making experiments that do not go on in the stomach. Those made by Mr. Muir were merely a waste of time and nothing more.

By the Recorder: I do not dispute the accuracy of Mr. Muir's experiments as he made them. My opinion of Mr. Muir's experiments as a chemist is a very high one, and I think he is a very admirable experimenter.

By Mr. Cockerell: Mr. Muir's experiments and mine are not comparable because he used hydrochloric acid, which is not all that the gastric juice contains, and my experiment was with the natural juices. Eight days' feeding of the pigs was fixed upon in order that they might get rid of the food they had had before and fill themselves with the bread. It was an improved diet for them. The food had no prejudicial effect whatever upon the lining of the stomach. I have used this baking powder for years for all kinds of pastry, cakes, &c.

By the Recorder: I have had no reason to complain of its having given dyspepsia, indigestion, or anything of the kind, nor have my wife or family.

By Mr. Cockerell: My chief article of nutrition is not bread, but my children live mainly upon bread food. We do not make bread with the baking powder; we prefer yeast bread.

The Recorder: Possibly a person living on this bread might suffer ill-effects from it, but would not a man suffer ill-effects who had nothing to eat but yeast bread?—It would be very injudicious in any one to live upon it.

Can you, after making these experiments, conscientiously say that you think there is nothing in this baking powder that is injurious to health?—I do not think there is, and I gave that opinion seven years ago.

You know the words of the Act of Parliament. Can you say, as a skilled witness, that there is nothing injurious to health in it?—I certainly do say so, and I would not allow it to be used in my house if I thought otherwise.

The Recorder asked if there was any need to go further after what this gentleman had said. This was a penal enactment, in which the first offence rendered a person liable to a penalty of £50, and the second to imprisonment, with hard labour, for a period not exceeding six calendar months. Could he be expected to confirm this conviction when a skilled witness like Mr. Sutton (for whose opinion he had the highest esteem) declared upon his oath that there was nothing injurious to health in the use of this baking powder, raising the question even upon the merits, without the question as to whether the case came within the statute?

Mr. Blofield said he should like to call Dr. Thudicum and Dr. Tidy in fairness to Messrs. Smith and Sons.—The Recorder assented, and

Dr. J. L. W. Thudicum, F.C.P., Lond., F.C.S., deposed: I have been frequently consulted on hygienic questions by the Government and by Boards of Health.

Mr. Blofeld: You have been present throughout this trial, and, having heard all the evidence that as been given, and the experiments that have been made by Mr. Muir and those of Mr. Sutton, and his xperience of this baking powder, is there in it in your opinion anything that is injurious to health?—n my opinion there is nothing injurious in the use of this baking powder.

Assuming that phosphate of alumina is formed in the stomach, would it or would it not be decomosed in the gastric juices in the stomach?—It would be entirely decomposed by the gastric juices in he stomach.

Do you admit that these is phosphate of alumina there?—I merely assume that there is for the urpose of this argument.

Is it your opinion that there is or is not?—It is not proved that there is.

By the Recorder: The decomposition would take place without any extra effort of the gastric juice. he difference it would make by its presence would be inappreciable.

By Mr. Blofeld: The hydrate of alumina in the bottle produced is perfectly harmless.

The Recorder (to Mr. Sutton): How much do you say you produced from a 2lb. loaf?—Six grains.

Dr. Thudicum: That rests upon the evidence of Mr. Sutton, and I coincide with it. It is perfectly armless.

Mr. Blofeld: Dr. Beverley may have taken 20 grains?—He might.

You have heard a good deal said about the diminution of the phosphoric acid absorbed into the ystem by the use of this baking powder, will you give us your opinion?—The diminution of phosphoric cid in the human body by the use of this baking bowder would be quite inappreciable, and would be of o consequence whatever to the body.

You heard Mr. Sutton give his evidence as to the experiment he made with the two pigs and the onclusion he came to. Do you agree with the conclusion he drew?—I agree with them, and think they re physiologically stronger than he put them.

The Recorder: You think the experiment was a satisfactory one?—Very so.

Mr. Cockerell, addressing the Recorder, said he took it that he had decided the case, and as he (Mr. ockerell) did not apprehend he should be able to alter the Recorder's view of the matter it would be bsurd for him to take up more time.

The Recorder said it was satisfactory to find that there was not so much difference between the entlemen on the one side and on the other. No one disputed the accuracy of the experiments made, ut upon the one side hydrochloric acid was used, and on the other side it was said by a very able entlemen that this acid was only one of the component parts of the gastric juice, and the experiment e made was strictly analogous to what took place in the human system.

Dr. Charles Meymott Tidy, M.B., F.C.S. (Professor of Chemistry, and of Forensic Medicine at the ondon Hospital, Medical Officer of Health for Islington, and late Deputy Medical Officer of Health for he City of London, &c.), was next sworn and examined by

Mr. Blofeld: The first question is as to phosphate of alumina being formed. Do you agree that it s formed in bread by the use of this baking powder, or is it an open question or not?—I think it is very mprobable that the phosphate of alumina is formed at all, because in order to form phosphate of lumina you must have actual contact between the phosphoric acid and the alumina, and I cannot see ow that can be brought about under the ordinary conditions of digestion, and even granting that it ccurs—and I don't think it makes the slightest difference in the case—even supposing that it does ccur, I know, as a matter of fact, that the phosphate of alumina is soluble in the gastric juices in weak cid solutions, and I know that when phosphate of alumina is in solution of that nature with the membrane between and the alkaline blood on the other side the whole of the phosphoric acid filters hrough into the blood. I know that as a laboratory experiment, and I know if that occurs as a laboratory xperiment it occurs much more rapidly in the living tissue.

Can you see anything on earth in the use of this baking powder which can be injurious to health?—No; most certainly not. I should like to say, in giving my opinion with respect to this powder, that I do not wish to express any opinion about alum in bread as a means of fraud. I conceive alum ought not to be used in large quantities, as it is not on the question of injury to the health, but for the reason that bread holds a larger quantity of water and bakers can use a very inferior quality of flour. I am only giving my opinion of this baking powder and not of the alum in bread-making.

Mr. Cockerell: Nor of the use of alum at all?—I do not give it, but simply as alum leads to fraud.

The Recorder: You think there is nothing injurious in this powder?—No, in the proportions in which it is possible to use it. It might be said, "Couldn't you put in a large quantity of this powder?" but this could not be done as it would spoil the bread entirely. Therefore it is utterly impossible to my mind that this powder could be used for the purpose of fraud from the point of view from which I put alum forward and from which alum is occasionally used.

Mr. Blofeld said he had Dr. Beverley here, but he did not think, after the evidence that had been given, it was necessary to call him. That was his case.

The Recorder, in giving judgment, said: It is unnecessary for me to express any opinion upon the legal point as to whether this case falls within the Act of Parliament; but if my opinion is worth anything to anybody I still adhere to the opinion I have already expressed, that it does not come within the Act for reasons, some of which I have already given. I decide this case upon its merits and upon the evidence. After the evidence we have just heard I do not think this baking powder is an article of food, or that bread made with it becomes an article of food injurious to health, and as a matter of fact, I find in favour of the appellants.

Mr. Blofeld: I have to ask for costs.

Mr. Cockerell: I never heard of any costs being given against magistrates. We come here to uphold the decision of the magistrates.

The Recorder: Who is the respondent?—Mr. Cockerell: Mr. Phillips, the provision inspector.

The Recorder: Who put the law in force?

Mr. Cockerell said proceedings were taken against the sellers of this powder at Cambridge, in consequence of a conviction that took place there of a man for selling buns made with this powder. The magistrates threw out a hint that proceedings should be taken against the sellers of the powder.

Mr. Blofeld said the buns in question could not have been made with this baking powder.

The Recorder also said that they could not have found alum in the buns if they were made with this powder.—Mr. Cockerell: They did not say it was alum.

Mr. Blofeld: They did say so, and here is the conviction to prove it. (Conviction handed in.) The persons who started these proceedings were a committee connected with the Corporation and not the magistrates.

The Recorder: I should be loth to make an order for costs, especially against Mr. Phillips, a public officer put forward by the Corporation to look after the health of the town, but if the conviction were sustained I see that the costs Mr. Phillips would have received from Messrs. Warren would have been £10 1s. Ordinarily speaking I should not think of giving costs against the magistrates nor against a public officer, but I should like to know the circumstances under which this prosecution was instituted.

Mr. Cockerell said he had stated the circumstances.

The Recorder—Where will the costs come from?—Mr. Cockerell did not know.

Mr. Horace Browne said they would come out of the Corporation. His learned friend Mr. Cockerell was being instructed by the Town Clerk.—After further opposition on the part of Mr. Cockerell,

The Recorder said: I do not see why the usual results should not follow upon a successful appeal. I quash the conviction, with costs. The costs allowed amounted to £100.

Mr. G. D. Macdougall has been appointed Public Analyst for Perthshire.

Mr. J. Napier has been appointed Public Analyst for the Borough of Ipswich, and also for East Suffolk.

Mr. J. Carter Bell has been appointed Public Analyst for Stalybridge.

REVIEWS.

A Year's Cookery. By Phillis Browne. Cassell, Petter & Galpin.

Cookery becomes more and more a question of chemistry, and the waste of food is, by this means, becoming reduced; therefore when a cookery book makes any claim to scientific accuracy it is a fit subject for review in our columns. The preface to this work says: "No work of the kind on this plan exists. I have specially addressed myself to people of moderate income, with moderate kitchen help and ordinary domestic utensils." It is seldom that we find such a bold statement as the *raison d'être* for a new book, but after carefully reading it through from beginning to end, we find that the contents fully justify the statement made. It is the most unique and complete book on cookery we have yet seen; unique in its conception, because a separate *menu* is provided, not only for each day of the year, but for every meal for each day; complete in its directions which not only give ordinary, and many extraordinary receipts; but even include in the proper time and place, such directions as: "Put a cupful of hominy in soak in cold water ready for to-morrow morning." A remarkable feature is the daily paragraph of things that must not be forgotten. Careful attention to these paragraphs, day by day, would cause a considerable reduction in the expenses of many households, where a large proportion of the food now cooked, or supposed to be cooked, is simply wasted. American cereals and tinned goods are judiciously referred to, and included in many of the dishes, and the novel receipts are not only numerous, but as far as we have yet tried them, generally good.

NOTES OF THE MONTH.

Two cases have been decided during the month on the subject of cream of tartar, and it has been held that the commercial salt, containing tartrate of lime, is a legal tender under that name. Modern *argol* certainly always contains a much larger proportion of lime than was formerly the case, owing to the almost universal custom of "plastering" the grape juice; but it is a question how far purification by recrystallization should be carried, before the crude *argol* can be sold as cream of tartar. There is no standard for this apparently, because that of the British Pharmacopœia is taken only when it suits the defence, and when it does not it is promptly repudiated. It is unfortunate, therefore, that some analysts should continue to take that standard without first making themselves acquainted with all the details of the manufacture and contents of commercial articles, as it only leads to action tending to discredit the general body. What an analyst ought to do in the case of his getting any article with the commonly recognised composition of which he is not experimentally familiar, was well stated by Dr. Dupré at our last meeting, when he said that, under such circumstances, the analyst should apply to our Secretaries to furnish him with the names of one or two of the members who had made a specialty of the subject, and then seek the advice of the gentlemen named before certifying. Had this been done in the cases in point the analyst would have doubtless been referred to one of our Vice-presidents, who is well-known for the depth of his information on everything relating to wine, and to our President, who is daily engaged in the study of all relating to drugs, and between them we are satisfied such advice would have been tendered as would have induced the insertion of some special remarks in the certificate, tending to prevent prosecution if possible. We trust that all our country friends will in future take this course, as all our specialists have expressed their perfect willingness to give such advice in every case. Members should not forget that the very object of our Society is mutual self-help, and no scruples of false delicacy should prevent their applying, as no man can hope to unite in himself a perfect practical familiarity with all the articles embraced in our very wide field of research, and it is no slur on his general knowledge that he requires now and then special enlightenment.

Of course the trade journals have their fling as usual when any prosecutions break down. The *Chemist and Druggist* comments on the cases in an article headed "Angellic Pharmacy," but as in this case it fairly confines its strictures to a particular analyst's evidence, and does not make it a handle to denounce the whole body of Public Analysts, we must leave the gentleman affected to take whatever remedy he may be advised to adopt, if he feels desirous of doing so. The *Pharmaceutical Journal*, on the other hand, talks loudly of our general incompetence, and suggests that *their* society should move so as to obtain a more rigid scrutiny of the knowledge of analysts before appointment. To the latter desire we have nothing to say, and *our* Society would cordially second any true effort to raise the standard of analysts; but to the cry of general incompetence we return a most unqualified denial, and, in support of that, we can point to the fact, referred to in our President's address, that England, as represented by our members, is at present the leading source of improvements in all processes used by Public Analysts, as evidenced by the 41 papers read before our Society or published in our columns during the past year.

While on this subject, we would ask the learned doctor who presides over the *Pharmaceutical Journal* what remedy he proposes in the matter? His own society has examinations continually increasing in stringency, and would he dare to say that, even then, every man who obtains the power to legally write himself pharmaceutical chemist is perfectly competent to deal with every prescription which may be submitted to him? If so, where the necessity for the "dispensing memoranda" for mutual self-help, which is so prominent a feature in his journal. Again, take the medical and legal professions, both of which guard their doors with the utmost jealousy, and do we there find each man universally cognisant of all diseases or points of law? If so, why the skin, ear, eye, and brain specialists, and why the conveyancer and special pleader? Hedge any scientific pursuit with as many barriers as you please, you cannot ensure universally competent men to deal with every special matter which may arise. Why then should Public Analysts be expected to be superhuman? If the same blaze of publicity was necessarily entailed on pharmacists as on Public Analysts we should soon see which body would come out most slightly scathed. There are no journals interested in holding up to public scorn every pharmacist who, when engaged in counter prescribing, mistakes the symptoms of his customer, and gives him a purge when he ought to have let him alone or referred him to a medical man; but woe betide the analyst who makes the slightest slip, for all his previous work goes for nothing! Let the Pharmaceutical Society render all its members perfectly free from even a chance of mistaken opinion before it undertakes to do the same to others.

Another disputed case has been heard on the subject of alum in baking powder, and it has been held that the use of that article, as a constituent in such mixtures, is not dangerous to health when combined with sodium carbonate. It is doubtless a great victory for the manufacturers, but we have yet to see its ultimate effect for public good. In this case, at all events, no blame can be laid to the door of the analyst, even by the most rabid detractor, seeing that it commenced by the prosecution of a baker for alum in buns, and on his stating that he used this powder, the magistrate directed an examination of the article, and prosecution of the manufacturers. All through the case Mr. Knights (ably seconded by Mr. Muir) acted with skill, and made a series of interesting experiments in support of the contention that alum rendered bread indigestible. The matter was forced upon the analyst, so the failure of the case can in no way be attributed to him. The result of the case does not interfere with the prohibition of the use of alum in bread, because even the defence witnesses (brought up at great cost it was stated) said that, in giving their opinion as to the innocence of this particular powder, they were not to be held to say that the addition of alum to bread was, in their opinion, allowable. There is no need to fight the question of danger to health, when the fact remains that the use of alum enables the baker to defraud the public by using inferior flour, and getting his loaves to hold more water, and it is on this view that certificates had better be drawn in future.

BOOKS, &c., RECEIVED.

The Art of Perfumery, by G. Septimus Piesse; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts Journal.

⁂ Owing to the pressure on our space this month, we are compelled to hold over several papers and other interesting matter already in type, especially a paper by Mr. West Knights, on his experiments in the Norfolk Baking Powder Case.

THE ANALYST.

MARCH, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, on Wednesday, the 18th February, the President, Dr. Muter, in the chair.

The Scrutineers appointed to examine the voting papers reported that Mr. T. P. Bruce Warren, Analytical Chemist and Telegraph Engineer, had been elected as a Member, and Mr. Lionel Stansell, Assistant to Mr. C. H. Piesse, as an Associate.

The following were proposed for election as Members:—

J. G. Tatters, Analytical Chemist, South Shields.

F. P. Perkins, Public Analyst for Exeter.

Elwyn Waller, Ph.D., F.A.C.S., School of Mines, Columbia College, New York.

H. A. Mott, Ph.D., F.A.C.S., 117, Wall Street, New York.

H. Lancaster Hobbs, Analytical Chemist, Holborn Viaduct.

The following papers were read and discussed:—

"Remarks on the Estimation of Milk Sugar," and "A Process for the Estimation of Cane Sugar in Milk," by J. Muter, Ph.D., M.A.

"On a New Method of Taking the Specific Gravity of Solid Fats at Ordinary Temperatures," by A. Wynter Blyth, M.R.C.S.

"On the Action of Alum in Bread-Making," by J. West-Knights, F.C.S.

"On Blowpipe Assays of Silver Lead," by F. Maxwell Lyte, F.C.S.

"On the Persistent Occurrence of Starch," by F. P. Perkins, Public Analyst for Exeter.

"A Series of Analyses of Air," by H. Macagno, Director of Agricultural Station, Palermo.

The next Meeting of the Society will be held at Burlington House, on Wednesday, March 17th.

REMARKS ON THE ESTIMATION OF MILK SUGAR.

By JOHN MUTER, PH.D., M.A., F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

I HAVE been for some time studying the behaviour of milk sugar with Fehling's solution, and now propose to lay a summary of my results before the Society, so as to give, if possible, an answer to the oft-repeated questions: (1) What is the best method for an analyst to follow? and (2) Given such method, what is the true equivalent for calculation of results? I do not propose to go at tedious length into all the numerous experiments on which I have based my conclusions; suffice it to say, that I have definitely formed the following opinions: (*a*) that the best process for general use is the gravimetric; (*b*) that it should be carried out according to strict rules so as to ensure a constant equivalent; (*c*) that the precipitate may be directly weighed as cuprous oxide (Cu_2O). I am aware that, at first sight, the propositions (*a*) and (*c*) will be at once mentally disputed by persons prejudiced by former training, because they would naturally consider the volumetric method to be more rapid, and at once declare that cuprous oxide is not stable, and ought to be first converted into cupric oxide before weighing. In answer to the first objection, I may say that when dealing with lactose, the volumetric method, in which the sugar must be brought into contact a little at a time with strong alkali, never gives really accurate results except by accident, and that a really constant equivalent cannot be ensured unless *the whole can be diluted to such a point as will render the alkali harmless, while the Fehling's solution is at once added in sufficient quantity to instantaneously perform the whole reaction, and both the sugar solution and the Fehling are actually boiling when mixed*, points only to be attained by the gravimetric process. In reply to the second prejudice, I say that cuprous oxide precipitated from boiling solutions, washed with boiling water so that it is never unduly exposed, and at once transferred to a good close drying chamber, in the air of which there is a little petroleum vapour, is really a more convenient and accurate article for weighing than the very hygroscopic cupric oxide. This I have proved again and again, and have definitely abandoned the conversion into CuO. With regard to the equivalent of milk sugar in copper, I have practically proved that the results of Herrn. Rodewald and Tollens *(Deut. Chem. Ges. Ber. II. 2076-84)* are accurate as to the alterations obtainable under various circumstances, but I say in addition that an extreme point of dilution may be obtained at which the alkali ceases to affect the process, provided the "Fehling" be added boiling, and at once in very slight excess, and the precipitate be not allowed to stand in contact with the re-agent for any length of time. At this point we obtain a constant-equivalent of 146·3 parts cuprous oxide for every 100 of lactose, (or in other words, 7·0 atoms of metallic copper for each molecule of anhydrous milk sugar) and so avoid dealing with fractions of atoms, which are on their very face most probably inaccurate, and the mere result of special accidental circumstances.

The exact details of the process by which this equivalent can be attained within a very small fraction are as follows:—

A 3½-inch Swedish filter is well dried at 212°, weighed rapidly between watch glasses, placed in a funnel, moistened, and the folded part well pressed to the funnel. The sugar solution is diluted with boiling water, until it does not contain more than ·1 per cent., and brought to brisk ebullition in a large beaker. A very slight excess of *boiling* "Fehling" is then added, and the whole kept boiling for three minutes and set to settle. In a very few minutes the precipitate will have subsided sufficiently to enable the slightly blue liquid to be poured off *quite close* into another beaker. 50 c.c. of boiling water are then poured on the precipitate, and it is kept warm over a low gas flame while the poured off liquid (which should also be kept nearly boiling) is passed through the filter if necessary, but generally this is not required, and always to be avoided if possible. As soon as this is done, the filter is washed with boiling water until all blue colour is washed out, and the main precipitate is then transferred to the filter, taking care that the latter is never more than half full, as the cuprous oxide creeps up very much. When all is on, it is rapidly washed with boiling water, until what passes through ceases to give a pink with a drop of spirituous solution of phenol-phthalein, and when perfectly drained, two drops of petroleum spirit are dropped on to the precipitate, and the filter is removed from the funnel and placed in a close drying oven at 212° on several folds of hot and dry blotting paper. In about half an hour it will be dry, and the whole is then rapidly weighed in the same watch glasses as were originally used, put back into the bath for a short time longer, and again weighed. If the weight be no less, then deduct the filter tare and say, as 146·3 : 100 : : weight of precipitate, which gives the amount of milk sugar in the original solution. The process can be completed in about two hours, and since I worked in this way I have rarely failed to get my equivalent. Departing even in the least, however, from these exact details, the equivalent may range from 145 to 150, and be quite a matter of accident. In fact, the whole estimation wants practice and rapidity, but that once attained, it is good.

A PROCESS FOR THE ESTIMATION OF THE AMOUNT OF CANE SUGAR ADDED TO MILK, TOGETHER WITH THE WATER THEREBY CONCEALED.

By John Muter, Ph.D., M.A., F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

The very extensive use of "Milk Improvers," and other similar nostrums, nearly all of which have for their object the defeat of ordinary methods of milk analysis, as well as the constantly increasing practice of making up a short supply by using condensed milk and water, renders it imperative that Public Analysts should be on their guard as to the presence of cane sugar. Happily the qualitative test is very simple, being that of taste, and it is only necessary to practise for some days the tasting of pure and sugared milk to render oneself perfectly proficient in detecting as little as 10 per cent. of sugar water of 9·3 per cent. which has a gravity corresponding nearly to that of milk, and the addition of which will not reduce the "solids not fat." The presence of sugar being thus suspected, the question of amount has to be settled, and I have thought it would be of general interest to our members that I should detail the process we have now for some time used at the South London Central Public Laboratory for this purpose, by which, as will be seen, the total sugar is *directly weighed*, and the estimated milk sugar having been deducted the difference expresses added sugar. It is as follows:—

Ten grammes of the milk are poured upon 4 grammes of hydrated calcium sulphate in a basin, and evaporated to perfect dryness, with frequent stirring, so that nothing sticks to the basin. The dry residue is powdered, macerated with ether, thrown on a *dried* filter over a tared beaker and percolated with ether till free from fat. The ether is then evaporated off, and the beaker *plus* fat is weighed, by which the percentage of fat is ascertained. The contents of the filter are then transferred to a beaker, together with the filter itself, and 20 c.c. of hot (but not actually boiling) water are added, and the whole well stirred. 30 c.c. of rectified spirit (60° o.p.) are then added, and the mixture is allowed to cool, stirring occasionally. When cool it is thrown on a filter placed over a long graduated measure, and washed with proof spirit (2 parts by volume of water, and 8 of 60 o.p. spirit) until the filtrate measures 120 c.c., at which point extraction is usually complete. The filtrate is then divided into two equal parts, and one portion is evaporated in a platinum dish and then placed in the drying oven at 212° till constant in weight. The weight is noted and the dish and contents are ignited for some time at a dull red heat and again weighed, when the total weight, less that of the dish *plus* ash, gives total sugar, which is multiplied by 20 to get percentage. The other portion of the filtrate has meanwhile been evaporated on the water-bath until the smell of spirit has passed off, and it is then washed into a large beaker, diluted with boiling water to 200 c.c., treated with boiling "Fehling," and the milk sugar is estimated exactly as described in my previous paper on that subject. The weight of the cuprous oxide obtained is multiplied by 20, and then calculated from 146 to 100. (The fraction of ·3 on the equivalent may be disregarded, as the process is not accurate within that amount.) The weight of milk sugar thus found is then deducted from the total sugar, and the difference (if over ·5) is put down as cane sugar. If over ·5 and under 1·0, a rebate of ·2 per cent., and if over 1 but under 1·5, an allowance of ·1 is to be made; but if the sugar reaches over 2 per cent., it may be taken as it stands, for the following reasons. Dealing with pure milk in a series of trials we got the following differences, due to the presence of bodies unestimated by "Fehling," or to natural inherent error.

Total sugar..	5·02	lowest.
Milk sugar	4·94	
Difference	·08	
Total sugar..	5·10	highest (probably loss in Cu_2O and carbon left in ash).
Milk sugar	4·77	
Difference	·33	
Total sugar..	5·00	fair average milk.
Milk sugar	4·80	
Difference	·20	

It is therefore evident that by allowing the extreme limit of ·5 before condemning a milk, we guard entirely against risk of error.

As the amount of cane sugar increases, and consequently also the water it conceals, the amount of natural error due to unestimable bodies sinks, as will be seen from the following experiments taken at random from our books, as being fair average ones to indicate the possible accuracy of the process.

1. A Milk containing 10 per cent. sugar water of 9·3 per cent. strength—

Total sugar	5·56
Milk sugar	4·45
Cane sugar found	1·11
„ „ by theory	·93
Difference	·18

2. A Milk with 20 per cent. of sugar water—

Total sugar	5·77
Milk sugar	3·80
Cane sugar found	1·97
„ „ by theory	1·86
Difference	·11

3. A Milk with 30 per cent. of sugar water—

Total sugar	6·18
Milk sugar	3·35
Cane sugar found	2·83
„ „ by theory	2·79
Difference	·04

The process is therefore reliable within an extreme of ·3 per cent., which is really, I believe, due to the difficulty of getting a perfect ash without either on the one hand leaving some charcoal, or on the other volatilizing some chlorides.

The analysis of the milk is completed by taking a total residue and ash in the usual way. As an example of how nearly the added water may be calculated, let us take Milk No. 1, which showed—

Total solids	12·39
Fat	2·90
Solids not fat	9·39
Ash	·71

And correct it as follows:—

Apparent solids, not fat	9·39
Cane sugar found	1·11
True solids not fat	8·28

then

$$\frac{8{\cdot}28 \times 100}{9} = 92 \text{ per cent. milk by the Society's limit.}$$

or

$$\frac{8{\cdot}28 \times 100}{9{\cdot}3} = 89 \text{ per cent. milk by Wanklyn's standard.}$$

Whereas it was as we have seen, actually 90 per cent. of pure milk, and would have passed as unadulterated if not examined by this process. I have used the process several times in actual practice, and in every case the use of condensed milk has been afterwards admitted in court, so I consider that it is one which may be safely recommended for general use, always remembering that *if after proper training of the palate you cannot taste sugar in a sample, there is no use seeking for it*, and, indeed, to do so is to invite chances of error.

I may mention that I am now experimenting on an inversion process, having, I believe, substantiated the fact that lactose does not invert into galactose by the ordinary method used with the sugar polariscope, viz.:—heating 50 c.c. sugar solution to 68° C. with 5 c.c. of fuming HCl, but my results are not sufficiently advanced to warrant any change in our process, and I doubt if the double determination of sugar will prove any advantage over the evaporation method as detailed in this paper, seeing that we cannot use the Fehling volumetrically with any real degree of certainty.

In the discussion which ensued, Mr. Wynter Blyth said he thought Dr. Muter was the first to establish in a court of law that cane sugar really is used in milk, and pointed out that analysts must look after that particular thing. As to extracting the sugar with solvents in the way indicated, he himself generally preferred to precipitate the caseine in the manner mentioned in his paper published last year in the *Journal of the Chemical Society*. By using that process fairly pure milk sugar crystals could be obtained, and sometimes he had got almost perfectly white crystals. He mentioned that the Tartars separated the sugar from milk by freezing the milk when a kind of white flour is formed on the ice. This flour they scrape off and make into cakes, which they eat.

Mr. Hehner said that one objection which had been urged against filtering the alkaline copper solution was that the solution acted very strongly upon some kinds of filter papers, and dissolved the cellulose in them, but

Dr. Muter said that in nine cases out of ten the solution did not act on the filter.

ON THE COMPOSITION OF UNFERMENTED WINES OF COMMERCE.

By J. Carter Bell.

Read before the Society of Public Analysts, on 14th Jan., 1880.

Lately I have had some of these so-called wines to examine, which were alleged to be manufactured from the pure juice of the grape. My opinion is, and I think it will be shared by those who study the following analyses, that the juice of the grape is totally absent. These samples of wine have been made the subject of legal proceedings, and the defendants on cross-examination stated that they were made from sugar, crystallised tartaric acid, salycylic acid, and one-sixth of grape juice.

No. 1 bottle was labelled: " Unfermented Port Wine, manufactured from the juice of the grape, for family and sacramental purposes."

Specific gravity 1100.	100 volumes contain	
Volatile acid, calculated as acetic	·006	
Tartaric acid	·502	
Sugar (invert)	21·2	
Ash	·0395	
Insoluble ash in water	·0185	or 46·8 per cent.
Soluble ash in water	·0210	or 53·1 ,,
Residue, dried at 230° F.	24·50	
Salycylic acid	·02	

The ash contained traces of chlorine, sulphuric acid, phosphoric acid and potash.

No. 2 bottle was labelled: " Unfermented Wine, Sherry, manufactured from the juice of the grape, for family and sacramental purposes."

Specific gravity 1098.		
Volatile acids, calculated as acetic	·006	
Tartaric acid	·581	
Sugar (invert)	22·900	
Ash	·019	
Insoluble ash in water	·009	or 47·3 per cent.
Soluble ash in water	·010	or 52·6 ,,
Residue, dried at 230° F.	25·421	
Salycylic acid	0·100	

This ash also contained traces of sulphuric acid, phosphoric acid, potash and soda.

No. 8 bottle was labelled: "Unfermented Juice of the Vine, pure uncoloured virgin fruit of the vine, nutriment of the grape without the irritant, for sacramental and dietetic purposes, and in all cases where wine is generally used. This alone should be used where any wine is required."

Specific gravity 1120.

Volatile acids, calculated as acetic	·005	
Sugar (invert)	28·502	
Tartaric acid	·616	
Ash	·026	
Insoluble ash in water	·012;	or 46·1 per cent.
Soluble ash in water	·014;	or 53·8 "
Residue, dried at 230°	29·821	
Salycylic acid	·123	

The price charged for these liquors was 2s. 6d. a bottle. I reported that they were merely solutions of sugar and tartaric acid, flavoured and coloured, and kept from fermenting by the addition of a little salycylic acid. I have made a partial analysis of the juice from black and white grapes to compare with the above.

Juice of Black English Grapes:—

Specific gravity 10835.

Residue at 212° F.	22·902	
Residue at 230° F.	18·615	
Sugar	13·210	
Total free acid, calculated as tartaric	·700	
Ash	·356	
Insoluble in water	·0336;	or 9·43 per cent.
Soluble in water	·3224;	or 90·56 "

Juice of White Almeria Grapes:—

Specific gravity 1071.

Residue at 212° F.	20·282	
Residue at 230° F.	15·960	
Sugar	12·60	
Total free acid, calculated as tartaric	·60	
Ash	·331	
Insoluble ash in water	·035;	or 10·57 per cent.
Soluble ash in water	·296;	or 89·42 "

I think it is very evident that one-sixth of grape juice is not in the so-called wines, for it would have raised the percentage of ash, and also have increased the percentage of solubility.

Mr. Heisch expressed his surprise that the case was taken into court. He could not understand what the nature and quality of an unfermented wine should be. In ancient time the juice of the grape was certainly looked upon as wine, but its keeping qualities were doubtful.

Mr. Allen thought it was clearly the purchaser's duty to take the matter into court. There was always some confusion in the English language between wine and vine, but if they called it unfermented wine it certainly represented that it was made from the vine.

Dr. Dupré regretted that such a case should have been brought into court. He himself was consulted by someone who wanted to institute a prosecution; he examined some wine, and substantially agreed with Mr. Bell's analysis. His sample was almost free from potash, he could not detect any with the spectroscope, consequently it was not juice of the grape; but then came the question—Was it manufactured from the juice of the grape? Was it cane sugar inverted by the use of tartaric acid? It was impossible to say whether invert sugar was cane sugar inverted, or whether it was grape. In the second place, the tartaric acid was undoubtedly derived from the grape. The chemist cannot say that it is not a sugar of the grape; he has to admit that tartaric acid comes from the grape, and for that reason he (Dr. Dupré) declined to have anything to do with the case. He could not possibly prove that it was not the juice of the grape, although it was obviously an imposture.

ALCOHOL TABLES,*

By Otto Hehner, F.C.S.

Every chemist who has to make alcohol determinations, must have felt the want of *complete* Alcohol Tables, such as would give for all possible specific gravities from pure water to absolute alcohol, the percentages of alcohol by weight, by volume, and of proof spirit. A great number of elaborate tables are in existence, and are to be found in every comprehensive work on chemistry, but there is none, as far as I am aware, which answers the requirements, giving at a glance the data above mentioned, without entailing the trouble of a calculation.

To meet that want, the following tables have been compiled and calculated.

The excellent tables of Fownes—giving the percentages by weight, of Gay Lussac—giving volumina, and of Drinkwater, are all at present in use, but unfortunately they do not agree absolutely with each other: thus, for instance, absolute alcohol according to Fownes and Kopp has a specific gravity at 15·5° C. of 0·7938, and according to Gay Lussac of 0·7946. All later investigators having confirmed the general accuracy of Fownes' table (which gives whole percentages only), this has been taken as the basis of calculation. But it became necessary to include in the table the specific gravity of proof spirit, which according to Drinkwater is 0·9198, corresponding to 49·24 per cent of alcohol by weight, in the tables, since all excise calculations are based upon proof spirit. According to Fownes, however, a specific gravity of 0·9198 does *not* correspond to 49·24 per cent. of alcohol, but to 49·37 per cent. This figure was consequently dove-tailed into the tables with as low gradients as possible.

The following rules were followed in the calculations.

To convert—

$$\text{Weight into volume} = \frac{\text{Specific gravity} \times \text{per cent. weight.}}{0{\cdot}7938}$$

$$\text{Volume into weight} = \frac{0{\cdot}7938 \times \text{per cent. volume.}}{\text{Specific gravity.}}$$

Volume into proof spirit = per cent. volume × 1·7525.

Weight into proof spirit = per cent. weight × specific gravity × 2·20771.

Degrees under proof are obtained by subtracting percentages of proof spirit lower than 100 from that figure, and degrees over proof by the subtraction of 100 from percentages of proof spirit lying between proof and absolute alcohol.

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* These Tables, of which we print four pages this month, will be comprised in four or five numbers of The Analyst, and the paging has been so arranged that when the volume is bound the whole of the *Tables may* be placed together.

All figures were calculated to the third decimal, and then abbreviated to the second.

The greatest possible care has been taken to exclude mistakes, and although it can hardly be hoped that such be entirely absent—considering that the table includes thousands of figures—they will, it is hoped, in no case be found serious.

No originality whatever is claimed for these tables, and if they be but found to save some trouble and calculation, the large amount of work which they embody will not have been expended in vain.

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
1·0000	0·00	0·00	0·00				
·9999	0·05	0·07	0·12	·9959	2·33	2·93	5·13
8	0·11	0·13	0·23	8	2·39	3·00	5·25
7	0·16	0·20	0·35	7	2·44	3·07	5·37
6	0·21	0·26	0·46	6	2·50	3·14	5·49
5	0·26	0·33	0·58	5	2·56	3·21	5·61
4	0·32	0·40	0·70	4	2·61	3·28	5·74
3	0·37	0·46	0·81	3	2·67	3·35	5·86
2	0·42	0·53	0·93	2	2·72	3·42	5·98
1	0·47	0·60	1·04	1	2·78	3·49	6·10
0	0·53	0·66	1·16	0	2·83	3·55	6·22
·9989	0·58	0·73	1·28	·9949	2·89	3·62	6·34
8	0·63	0·79	1·39	8	2·94	3·69	6·47
7	0·68	0·86	1·51	7	3·00	3·76	6·58
6	0·74	0·93	1·62	6	3·06	3·83	6·72
5	0·79	0·99	1·74	5	3·12	3·90	6·84
4	0·84	1·06	1·86	4	3·18	3·98	6·97
3	0·89	1·13	1·97	3	3·24	4·05	7·10
2	0·95	1·19	2·09	2	3·29	4·12	7·23
1	1·00	1·26	2·20	1	3·35	4·20	7·36
0	1·06	1·34	2·34	0	3·41	4·27	7·49
·9979	1·12	1·42	2·48	·9939	3·47	4·34	7·61
8	1·19	1·49	2·61	8	3·53	4·42	7·74
7	1·25	1·57	2·75	7	3·59	4·49	7·87
6	1·31	1·65	2·89	6	3·65	4·56	8·00
5	1·37	1·73	3·03	5	3·71	4·63	8·13
4	1·44	1·81	3·16	4	3·76	4·71	8·26
3	1·50	1·88	3·30	3	3·82	4·78	8·38
2	1·56	1·96	3·44	2	3·88	4·85	8·51
1	1·62	2·04	3·58	1	3·94	4·93	8·64
0	1·69	2·12	3·71	0	4·00	5·00	8·77
·9969	1·75	2·20	3·85	·9929	4·06	5·08	8·90
8	1·81	2·27	3·99	8	4·12	5·16	9·04
7	1·87	2·35	4·12	7	4·19	5·24	9·18
6	1·94	2·43	4·26	6	4·25	5·32	9·31
5	2·00	2·51	4·40	5	4·31	5·39	9·45
4	2·06	2·58	4·52	4	4·37	5·47	9.58
3	2·11	2·62	4·64	3	4·44	5·55	9·72
2	2·17	2·72	4·76	2	4·50	5·63	9·86
1	2·22	2·79	4·89	1	4·56	5·71	9·99
0	2·28	2·86	5·01	0	4·62	5·78	10·13

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C·	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9919	4·69	5·86	10·26	·9869	8·00	9·95	17·43
8	4·75	5·94	10·40	8	8·07	10·03	17·58
7	4·81	6·02	10·54	7	8·14	10·12	17·74
6	4·87	6·10	10·67	6	8·21	10·21	17·89
5	4·94	6·17	10·81	5	8·29	10·30	18·04
4	5·00	6·24	10·94	4	8·36	10·38	18·20
3	5·06	6·32	11·08	3	8·43	10·47	18·35
2	5·12	6·40	11·21	2	8·50	10·56	18·50
1	5·19	6·48	11·35	1	8·57	10·65	18·65
0	5·25	6·55	11·49	0	8·64	10·73	18·81
·9909	5·31	6·63	11·62	·9859	8·71	10·82	18·96
8	5·37	6·71	11·76	8	8·79	10·91	19·11
7	5·44	6·78	11·89	7	8·86	11·00	19·27
6	5·50	6·86	12·03	6	8·93	11·08	19·42
5	5·56	6·94	12·16	5	9·00	11·17	19·58
4	5·62	7·01	12·30	4	9·07	11·26	19·73
3	5·69	7·09	12·43	3	9·14	11·35	19·89
2	5·75	7·17	12·57	2	9·21	11·44	20·04
1	5·81	7·25	12·70	1	9·29	11·52	20·19
0	5·87	7·32	12·84	0	9·36	11·61	20·35
·9899	5·94	7·40	12·97	·9849	9·43	11·70	20·50
8	6·00	7·48	13·11	8	9·50	11·79	20·65
7	6·07	7·57	13·27	7	9·57	11·87	20·81
6	6·14	7·66	13·42	6	9·64	11·96	20·96
5	6·21	7·74	13·57	5	9·71	12·05	21·11
4	6·28	7·83	13·73	4	9·79	12·13	21·27
3	6·36	7·92	13·88	3	9·86	12·22	21·42
2	6·43	8·01	14·04	2	9·93	12·31	21·57
1	6·50	8·10	14·19	1	10·00	12·40	21·73
0	6·57	8·18	14·35	0	10·08	12·49	21·89
·9889	6·64	8·27	14·50	·9839	10·15	12·58	22·06
8	6·71	8·36	14·66	8	10·23	12·68	22·22
7	6·78	8·45	14·81	7	10·31	12·77	22·38
6	6·86	8·54	14·96	6	10·38	12·87	22·55
5	6·93	8·63	15·12	5	10·46	12·96	22·71
4	7·00	8·72	15·27	4	10·54	13·05	22·88
3	7·07	8·80	15·42	3	10·62	13·15	23·04
2	7·13	8·88	15·56	2	10·69	13·24	23·21
1	7·20	8·96	15·70	1	10·77	13·34	23·37
0	7·27	9·04	15·85	0	10·85	13·43	23·54
·9879	7·33	9·13	15·99	·9829	10·92	13·52	23·70
8	7·40	9·21	16·14	8	11·00	13·62	23·86
7	7·47	9·29	16·28	7	11·08	13·71	24·03
6	7·53	9·37	16·42	6	11·15	13·81	24·19
5	7·60	9·45	16·57	5	11·23	13·90	24·36
4	7·67	9·54	16·71	4	11·31	13·99	24·52
3	7·73	9·62	16·86	3	11·38	14·09	24·69
2	7·80	9·70	17·00	2	11·46	14·18	24·85
1	7·87	9·78	17·14	1	11·54	14·27	25·01
0	*7·93*	*9·86*	17·29	0	11·62	14·37	25·18

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9819	11·69	14·46	25·34	·9769	15·75	19·39	33·96
8	11·77	14·56	25·51	8	15·83	19·49	34·14
7	11·85	14·65	25·67	7	15·92	19·59	34·32
6	11·92	14·74	25·83	6	16·00	19·68	34·50
5	12·00	14·84	26·00	5	16·08	19·78	34·66
4	12·08	14·93	26·17	4	16·15	19·87	34·82
3	12·15	15·02	26·33	3	16·23	19·96	34·98
2	12·23	15·12	26·49	2	16·31	20·06	35·14
1	12·31	15·21	26·66	1	16·38	20·15	35·31
0	12·38	15·30	26·82	0	16·46	20·24	35·47
·9809	12·46	15·40	26·99	·9759	16·54	20·33	35·63
8	12·54	15·49	27·15	8	16·62	20·43	35·79
7	12·62	15·58	27·31	7	16·69	20·52	35·95
6	12·69	15·68	27·48	6	16·77	20·61	36·12
5	12·77	15·77	27·64	5	16·85	20·71	36·28
4	12·85	15·86	27·81	4	16·92	20·80	36·44
3	12·92	15·96	27·97	3	17·00	20·89	36·60
2	13·00	16·05	28·13	2	17·08	20·99	36·78
1	13·08	16·15	28·29	1	17·17	21·09	36·95
0	13·15	16·24	28·46	0	17·25	21·19	37·13
·9799	13·23	16·33	28·62	·9749	17·33	21·29	37·30
8	13·31	16·43	28·78	8	17·42	21·39	37·48
7	13·38	16·52	28·95	7	17·50	21·49	37·65
6	13·46	16·61	29·11	6	17·58	21·59	37·83
5	13·54	16·70	29·27	5	17·67	21·69	38·00
4	13·62	16·80	29·43	4	17·75	21·79	38·18
3	13·69	16·89	29·60	3	17·83	21·89	38·35
2	13·77	16·98	29·76	2	17·92	21·99	38·53
1	13·85	17·08	29·92	1	18·00	22·09	38·71
0	13·92	17·17	30·09	0	18·08	22·18	38·87
·9789	14·00	17·26	30·26	·9739	18·15	22·27	39·03
8	14·09	17·37	30·45	8	18·23	22·36	39·18
7	14·18	17·48	30·64	7	18·31	22·46	39·35
6	14·27	17·59	30·83	6	18·38	22·55	39·51
5	14·36	17·70	31·03	5	18·46	22·64	39·68
4	14·45	17·81	31·22	4	18·54	22·73	39·84
3	14·55	17·92	31·41	3	18·62	22·82	40·00
2	14·64	18·03	31·61	2	18·69	22·92	40·16
1	14·73	18·14	31·80	1	18·77	23·01	40·32
0	14·82	18·25	31·99	0	18·85	23·10	40·48
·9779	14·91	18·36	32·19	·9729	18·92	23·19	40·64
8	15·00	18·48	32·38	8	19·00	23·28	40·80
7	15·08	18·58	32·56	7	19·08	23·38	40·98
6	15·17	18·68	32·73	6	19·17	23·48	41·15
5	15·25	18·78	32·91	5	19·25	23·58	41·33
4	15·33	18·88	33·08	4	19·33	23·68	41·50
3	15·42	18·98	33·26	3	19·42	23·78	41·68
2	15·50	19·08	33·44	2	19·50	23·88	41·85
1	15·58	19·18	33·61	1	19·58	23·98	42·03
0	15·67	19·28	33·79	0	19·67	24·08	42·20

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9719	19·75	24·18	42·38	·9669	23·69	28·86	50·57
8	19·83	24·28	42·55	8	23·77	28·95	50·73
7	19·92	24·38	42·73	7	23·85	29·04	50·89
6	20·00	24·48	42·90	6	23·92	29·13	51·05
5	20·08	24·58	43·07	5	24·00	29·22	51·21
4	20·17	24·68	43·25	4	24·08	29·31	51·37
3	20·25	24·78	43·42	3	24·15	29·40	51·53
2	20·33	24·88	43·60	2	24·23	29·49	51·69
1	20·42	24·98	43·77	1	24·31	29·58	51·84
0	20·50	25·07	43·94	0	24·38	29·67	52·00
·9709	20·58	25·17	44·12	·9659	24·46	29·76	52·16
8	20·67	25·27	44·29	8	24·54	29·86	52·32
7	20·75	25·37	44·47	7	24·62	29·95	52·48
6	20·83	25·47	44.64	6	24·69	30·04	52·64
5	20·92	25·57	44·81	5	24·77	30·13	52·80
4	21·00	25·67	44·99	4	24·85	30·22	52·95
3	21·08	25·76	45·15	3	24·92	30·31	53·11
2	21·15	25·86	45·31	2	25·00	30·40	53·27
1	21·23	25·95	45·47	1	25·07	30·48	53·42
0	21·31	26·04	45·63	0	25·14	30·57	53·56
·9699	21·38	26·13	45·79	·9649	25·21	30·65	53·71
8	21·46	26·22	45·95	8	25·29	30·73	53·86
7	21·54	26·31	46·11	7	25·36	30·82	54·00
6	21·62	26·40	46·27	6	25·43	30·90	54·15
5	21·69	26·49	46·43	5	25·50	30·98	54·30
4	21·77	26·58	46·59	4	25·57	31·07	54·44
3	21·85	26·67	46·75	3	25·64	31·15	54·59
2	21·92	26·77	46·91	2	25·71	31·23	54·74
1	22·00	26·86	47·07	1	25·79	31·32	54·88
0	22·08	26·95	47·23	0	25·86	31·40	55·03
·9689	22·15	27·04	47·39	·9639	25·93	31·48	55·18
8	22·23	27·13	47·55	8	26·00	31·57	55·32
7	22·31	27·22	47·70	7	26·07	31·65	55·46
6	22·38	27·31	47·86	6	26·13	31·72	55·59
5	22·46	27·40	48·02	5	26·20	31·80	55·73
4	22·54	27·49	48·18	4	26·27	31·88	55·87
3	22·62	27·59	48·34	3	26·33	31·96	56·00
2	22·69	27·68	48·50	2	26·40	32·03	56·14
1	22·77	27·77	48·66	1	26·47	32·11	56·27
0	22·85	27·86	48·82	0	26·53	32·19	56·41
·9679	22·92	27·95	48·98	·9629	26·60	32·27	56·55
8	23·00	28·04	49·14	8	26·67	32·34	56·68
7	23·08	28·13	49·30	7	26·73	32·42	56·82
6	23·15	28·22	49·46	6	26·80	32·50	56·95
5	23·23	28·31	49·62	5	26·87	32·58	57·09
4	23·31	28·41	49·78	4	26·93	32·65	57·23
3	23·38	28·50	49·94	3	27·00	32·73	57·36
2	23·46	28·59	50·10	2	27·07	32·81	57·51
1	23·54	28·68	50·25	1	27·14	32·90	57·65
0	23·62	28·77	50·41	0	27·21	32·98	57·80

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9619	27·29	33·06	57·94	·9569	30·50	36·76	64·43
8	27·36	33·15	58·09	8	30·56	36·83	64·54
7	27·43	33·23	58·24	7	30·61	36·89	64·65
6	27·50	33·31	58·38	6	30·67	36·95	64·76
5	27·57	33·39	58·53	5	30·72	37·02	64·87
4	27·64	33·48	58·67	4	30·78	37·08	64·98
3	27·71	33·56	58·82	3	30·83	37·14	65·10
2	27·79	33·64	58·97	2	30·89	37·20	65·21
1	27·86	33·73	59·11	1	30·94	37·27	65·32
0	27·93	33·81	59·26	0	31·00	37·34	65·43
·9609	28·00	33·89	59·40	·9559	31·06	37·41	65·55
8	28·06	33·97	59·53	8	31·12	37·48	65·68
7	28·12	34·04	59·65	7	31·19	37·55	65·80
6	28·19	34·11	59·78	6	31·25	37·62	65·93
5	28·25	34·18	59·90	5	31·31	37·69	66·05
4	28·31	34·25	60·03	4	31·37	37·76	66·18
3	28·37	34·33	60·16	3	31·44	37·83	66·30
2	28·44	34·40	60·28	2	31·50	37·90	66·43
1	28·50	34·47	60·41	1	31·56	37·97	66·55
0	28·56	34·54	60·53	0	31·62	38·04	66·68
·9599	28·62	34·61	60·66	·9549	31·69	38·11	66·80
8	28·69	34·69	60·79	8	31·75	38·18	66·93
7	28·75	34·76	60·91	7	31·81	38·25	67·05
6	28·81	34·83	61·04	6	31·87	38·33	67·17
5	28·87	34·90	61·16	5	31·94	38·40	67·30
4	28·94	34·97	61·29	4	32·00	38·47	67·42
3	29·00	35·05	61·42	3	32·06	38·53	67·55
2	29·07	35·12	61·55	2	32·12	38·60	67·67
1	29·13	35·20	61·69	1	32·19	38·68	67·80
0	29·20	35·28	61·82	0	32·25	38·75	67·92
·9589	29·27	35·35	61·95	·9539	32·31	38·82	68·04
8	29·33	35·43	62·09	8	32·37	38·89	68·17
7	29·40	35·51	62·22	7	32·44	38·96	68·29
6	29·47	35·58	62·36	6	32·50	39·04	68·42
5	29·53	35·66	62·49	5	32·56	39·11	68·54
4	29·60	35·74	62·63	4	32·62	39·18	68·67
3	29·67	35·81	62·76	3	32·69	39·25	68·79
2	29·73	35·89	62·90	2	32·75	39·32	68·92
1	29·80	35·97	63·03	1	32·81	39·40	69·04
0	29·87	36·04	63·17	0	32·87	39·47	69·16
·9579	29·93	36·12	63·30	·9529	32·94	39·54	69·29
8	30·00	36·20	63·43	8	33·00	39·61	69·41
7	30·06	36·26	63·55	7	33·06	39·68	69·53
6	30·11	36·32	63·66	6	33·12	39·74	69·65
5	30·17	36·39	63·77	5	33·18	39·81	69·76
4	30·22	36·45	63·88	4	33·24	39·87	69·88
3	30·28	36·51	63·99	3	33·29	39·94	69·99
2	30·33	36·57	64·10	2	33·35	40·01	70·11
1	30·39	36·64	64·21	1	33·41	40·07	70·23
0	30·44	36·70	64·32	0	33·47	40·14	70·34

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C·	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9519	**33·53**	**40·20**	**70·46**	·9469	**36·06**	**43·01**	**75·37**
8	33·59	40·27	70·57	8	36·11	43·07	75·48
7	33·65	40·34	70·69	7	36·17	43·13	75·59
6	33·71	40·40	70·81	6	36·22	43·19	75·70
5	33·76	40·47	70·92	5	36·28	43·26	75·80
4	33·82	40·53	71·04	4	36·33	43·32	75·91
3	33·88	40·60	71·15	3	36·39	43·38	76·02
2	33·94	40·67	71·27	2	36·44	43·44	76·13
1	34·00	40·74	71·39	1	36·50	43·50	76·24
0	34·05	40·79	71·48	0	36·56	43·56	76·34
·9509	**34·10**	**40·84**	**71·58**	·9459	36·61	**43·63**	**76·45**
8	34·14	40·90	71·67	8	36·67	43·69	76·56
7	34·19	40·95	71·76	7	36·72	43·75	76·67
6	34·24	41·00	71·85	6	36·78	43·81	76·78
5	34·29	41·05	71·94	5	36·83	43·87	76·88
4	34·33	41·11	72·04	4	36·89	43·93	76·99
3	34·38	41·16	72·13	3	36·94	44·00	77·10
2	34·43	41·21	72·22	2	37·00	44·06	77·21
1	34·48	41·26	72·31	1	37·06	44·12	77·32
0	34·52	41·32	72·41	0	37·11	44·18	77·42
·9499	**34·57**	**41·37**	**72·50**	·9449	37·17	**44·24**	**77·53**
8	34·62	41·42	72·59	8	37·22	44·30	77·64
7	34·67	41·48	72·68	7	37·28	44·36	77·75
6	34·71	41·53	72·78	6	37·33	44.43	77·85
5	34·76	41·58	72·87	5	37·39	44·49	77·96
4	34·81	41·63	72·96	4	37·44	44·55	78·07
3	34·86	41·69	73·05	3	37·50	44·61	78·18
2	34·90	41·74	73·14	2	37·56	44·67	78·28
1	34·95	41·79	73·24	1	37·61	44·73	78·39
0	35·00	41·84	73·33	0	37·67	44·79	78·50
·9489	**35·05**	**41·90**	**73·43**	·9439	**37·72**	**44·86**	**78·61**
8	35·10	41·95	73·52	8	37·78	44·92	78·71
7	35·15	42·01	73·62	7	37·83	44·98	78·82
6	35·20	42·06	73·72	6	37·89	45·04	78·93
5	35·25	42·12	73·81	5	37·94	45·10	79·04
4	35·30	42·17	73·91	4	38·00	45·16	79·14
3	35·35	42·23	74·01	3	38·06	45·22	79·25
2	35·40	42·29	74·10	2	38·11	45·28	79·36
1	35·45	42·34	74·20	1	38·17	45·34	79·46
0	35·50	42·40	74·30	0	38·22	45·41	79·57
·9479	**35·55**	**42·45**	**74·39**	·9429	**38·28**	**45·47**	**79·68**
8	35·60	42·51	74·49	8	38·33	45·53	79·79
7	35·65	42·56	74·59	7	38·39	45·59	79·89
6	35·70	42·62	74·68	6	38·44	45·65	80·00
5	35·75	42·67	74·78	5	38·50	45·71	80·11
4	35·80	42·73	74·88	4	38·56	45·77	80·21
3	35·85	42·78	74·97	3	38·61	45·83	80·32
2	35·90	42·84	75·07	2	38·67	45·89	80·43
1	*35·95*	42·89	75·17	1	38·72	45·95	80·53
0	*36·00*	*42·95*	75·26	0	38·78	46·02	80·64

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9419	**38·83**	**46·08**	**80·75**	**·9369**	**41·35**	**48·80**	**85·53**
8	38·89	46·14	80·86	8	41·40	48·86	85·62
7	38·94	46·20	80·96	7	41·45	48·91	85·71
6	39·00	46·26	81·07	6	41·50	48·97	85·81
5	39·05	46·32	81·17	5	41·55	49·02	85·90
4	39·10	46·37	81·26	4	41·60	49·07	86·00
3	39·15	46·42	81·36	3	41·65	49·13	86·09
2	39·20	46·48	81·45	2	41·70	49·18	86·18
1	39·25	46·53	81·55	1	41·75	49·23	86·28
0	39·30	46·59	81·64	0	41·80	49·29	86·37
·9409	**39·35**	**46·64**	**81·74**	**·9359**	**41·85**	**49·34**	**86·47**
8	39·40	46·70	81·83	8	41·90	49·40	86·56
7	39·45	46·75	81·93	7	41·95	49·45	86·65
6	39·50	46·80	82·02	6	42·00	49·50	86·75
5	39·55	46·86	82·12	5	42·05	49·55	86·84
4	39·60	46·91	82·21	4	42·10	49·61	86·93
3	39·65	46·97	82·31	3	42·14	49·66	87·02
2	39·70	47·02	82·40	2	42·19	49·71	87·11
1	39·75	47·08	82·50	1	42·24	49·76	87·20
0	39·80	47·13	82·59	0	42·29	49·81	87·29
·9399	**39·85**	**47·18**	**82·69**	**·9349**	**42·33**	**49·86**	**87·37**
8	39·90	47·24	82·78	8	42·38	49·91	87·46
7	39·95	47·29	82·88	7	42·43	49·96	87·55
6	40·00	47·35	82·97	6	42·48	50·01	87·64
5	40·05	47·40	83·07	5	42·52	50·06	87·73
4	40·10	47·45	83·16	4	42·57	50·11	87·82
3	40·15	47·51	83·26	3	42·62	50·16	87·91
2	40·20	47·56	83·35	2	42·67	50·21	88·00
1	40·25	47·62	83·45	1	42·71	50·26	88·09
0	40·30	47·67	83·54	0	42·76	50·31	88·18
·9389	**40·35**	**47·72**	**83·64**	**·9339**	**42·81**	**50·37**	**88·26**
8	40·40	47·78	83·73	8	42·86	50·42	88·35
7	40·45	47·83	83·83	7	42·90	50·47	88·44
6	40·50	47·89	83·92	6	42·95	50·52	88·53
5	40·55	47·94	84·02	5	43·00	50·57	88·62
4	40·60	47·99	84·11	4	43·05	50·62	88·71
3	40·65	48·05	84·21	3	43·10	50·67	88·79
2	40·70	48·10	84·30	2	43·14	50·72	88·88
1	40·75	48·16	84·39	1	43·19	50·77	88·97
0	40·80	48·21	84·49	0	43·24	50·82	89·06
·9379	**40·85**	**48·26**	**84·58**	**·9329**	**43·29**	**50·87**	**89·15**
8	40·90	48·32	84·68	8	43·33	50·92	89·24
7	40·95	48·37	84·77	7	43·39	50·97	89·33
6	41·00	48·43	84·87	6	43·43	51·02	89·41
5	41·05	48·48	84·96	5	43·48	51·07	89·50
4	41·10	48·54	85·06	4	43·52	51·12	89·59
3	41·15	48·59	85·15	3	43·57	51·17	89·68
2	41·20	48·64	85·24	2	43·62	51·22	89·77
1	41·25	48·70	85·34	1	43·67	51·27	89·86
0	41·30	48·75	85·43	0	43·71	51·32	89·95

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9319	43·76	51·38	90·03	·9269	46·05	53·77	94·22
8	43·81	51·43	90·12	8	46·09	53·81	94·31
7	43·86	51·48	90·21	7	46·14	53·86	94·39
6	43·90	51·53	90·30	6	46·18	53·91	94·47
5	43·95	51·58	90·39	5	46·23	53·95	94·55
4	44·00	51·63	90·48	4	46·27	54·00	94·64
3	44·05	51·68	90·56	3	46·32	54·05	94·72
2	44·09	51·72	90·64	2	46·36	54·10	94·80
1	44·14	51·77	90·73	1	46·41	54·14	94·89
0	44·18	51·82	90·81	0	46·46	54·19	94·97
·9309	44·23	51·87	90·89	·9259	46·50	54·24	95·05
8	44·27	51·91	90·98	8	46·55	54·29	95·13
7	44·32	51·96	91·06	7	46·59	54·33	95·22
6	44·36	52·01	91·14	6	46·64	54·38	95·30
5	44·41	52·06	91·23	5	46·68	54·43	95·38
4	44·46	52·10	91·31	4	46·73	54·47	95·46
3	44·50	52·15	91·39	3	46·77	54·52	95·55
2	44·55	52·20	91·48	2	46·82	54·57	95·63
1	44·59	52·25	91·56	1	46·86	54·62	95·71
0	44·64	52·29	91·64	0	46·91	54·66	95·79
·9299	44·68	52·34	91·73	·9249	46·96	54·71	95·88
8	44·73	52·39	91·81	8	47·00	54·76	95·96
7	44·77	52·44	91·90	7	47·05	54·80	96·04
6	44·82	52·48	91·98	6	47·09	54·85	96·12
5	44·86	52·53	92·06	5	47·14	54·90	96·21
4	44·91	52·58	92·15	4	47·18	54·95	96·29
3	44·96	52·63	92·23	3	47·23	54·99	96·37
2	45·00	52·68	92·31	2	47·27	55·04	96·45
1	45·05	52·72	92·40	1	47·32	55·09	96·53
0	45·09	52·77	92·48	0	47·36	55·13	96·62
·9289	45·14	52·82	92·56	·9239	47·41	55·18	96·70
8	45·18	52·87	92·64	8	47·46	55·23	96·78
7	45·23	52·91	92·73	7	47·50	55·27	96·86
6	45·27	52·96	92·81	6	47·55	55·32	96·95
5	45·32	53·01	92·89	5	47·59	55·37	97·03
4	45·36	53·06	92·98	4	47·64	55·41	97·11
3	45·41	53·10	93·06	3	47·68	55·46	97·19
2	45·46	53·15	93·14	2	47·73	55·51	97·27
1	45·50	53·20	93·23	1	47·77	55·55	97·36
0	45·55	53·24	93·31	0	47·82	55·60	97·44
·9279	45·59	53·29	93·39	·9229	47·86	55·65	97·52
8	45·64	53·34	93·48	8	47·91	55·69	97·60
7	45·68	53·39	93·56	7	47·96	55·74	97·68
6	45·73	53·43	93·64	6	48·00	55·79	97·77
5	45·77	53·48	93·73	5	48·05	55·83	97·85
4	45·82	53·53	93·81	4	48·09	55·88	97·93
3	45·86	53·58	93·89	3	48·14	55·93	98·01
2	45·91	53·62	93·98	2	48·18	55·97	98·09
1	45·96	53·67	94·06	1	48·23	56·02	98·18
0	46·00	53·72	94·14	0	48·27	56·07	98·26

Sp. Gravity at 60° F.= 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F.= 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9219	48·32	56·11	98·34	·9169	50·57	58·41	102·35
8	48·36	56·16	98·42	8	50·61	58·45	102·43
7	48·41	56·21	98·50	7	50·65	58·50	102·51
6	48·46	56·25	98·59	6	50·70	58·54	102·59
5	48·50	56·30	98·67	5	50·74	58·58	102·66
4	48·55	56·35	98·75	4	50·78	58·63	102·74
3	48·59	56·40	98·83	3	50·83	58·67	102·82
2	48·64	56·44	98·91	2	50·87	58·72	102·89
1	48·68	56·49	99·00	1	50·91	58·76	102·97
0	48·73	56·54	99·08	0	50·96	58·80	103·05
·9209	48·77	56·58	99·16	·9159	51·00	58·85	103·12
8	48·82	56·63	99·24	8	51·04	58·89	103·20
7	48·86	56·68	99·32	7	51·08	58·93	103·27
6	48·91	56·72	99·41	6	51·13	58·97	103·34
5	48·96	56·77	99·49	5	51·17	59·01	103·41
4	49·00	56·82	99·57	4	51·21	59·05	103·49
3	49·04	56·86	99·64	3	51·25	59·09	103·56
2	49·08	56·90	99·71	2	51·29	59·14	103·63
1	49·12	56·94	99·78	1	51·33	59·18	103·71
0	49·16	56·98	99·86	0	51·38	59·22	103·78
·9199	49·20	57·02	99·93	·9149	51·42	59·26	103·85
Proof. 8	49.24	57·06	100·00	8	51·46	59·30	103·92
7	49·29	57·10	100·08	7	51·50	59·34	104·00
6	49·34	57·15	100·17	6	51·54	59·39	104·07
5	49·39	57·20	100·25	5	51·58	59·43	104·14
4	49·44	57·25	100·34	4	51·63	59·47	104·21
3	49·49	57·30	100·42	3	51·67	59·51	104·29
2	49·54	57·35	100·51	2	51·71	59·55	104·36
1	49·59	57·40	100·59	1	51·75	59·59	104·43
0	49·64	57·45	100·68	0	51·79	59·63	104·50
·9189	49·68	57·49	100·76	·9139	51·83	59·68	104·58
8	49·73	57·54	100·85	8	51·88	59·72	104·65
7	49·77	57·59	100·93	7	51·92	59·76	104·72
6	49·82	57·64	101·02	6	51·96	59·80	104·80
5	49·86	57·69	101·10	5	52·00	59·84	104·87
4	49·91	57·74	101·19	4	52·05	59·89	104·95
3	49·95	57·79	101·27	3	52·09	59·93	105·03
2	50·00	57·84	101·36	2	52·14	59·98	105·11
1	50·04	57·88	101·43	1	52·18	60·02	105·19
0	50·09	58·92	101·51	0	52·23	60·07	105·27
·9179	50·13	57·97	101·59	·9129	52·27	60·12	105·35
8	50·17	58·01	101·66	8	52·32	60·16	105·43
7	50·22	58·06	101·74	7	52·36	60·21	105·51
6	50·26	58·10	101·82	6	52·41	60·25	105·59
5	50·30	58·14	101·89	5	52·45	60·30	105·67
4	50·35	58·19	101·97	4	52·50	60·34	105·75
3	50·39	58·23	102·05	3	52·55	60·39	105·83
2	50·43	58·28	102·12	2	52·59	60·44	105·91
1	50·48	58·32	102·20	1	52·64	60·47	105·99
0	50·52	58·36	102·28	0	52·68	60·52	106·07

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit per cent.
·9119	**52·73**	**60·56**	**106·15**	**·9069**	**55·00**	**62·84**	**110·12**
8	52·77	60·61	106·23	8	55·05	62·88	110·20
7	52·82	60·65	106·31	7	55·09	62·93	110·28
6	52·86	60·70	106·39	6	55·14	62·97	110·36
5	52·91	60·74	106·47	5	55·18	63·02	110·44
4	52·95	60·79	106·55	4	55·23	63·06	110·52
3	53·00	60·85	106·63	3	55·27	63·11	110·60
2	53·04	60·89	106·71	2	55·32	63·15	110·68
1	53·09	60·93	106·78	1	55·36	63·20	110·76
0	53·13	60·97	106·86	0	55·41	63·24	110·84
·9109	**53·17**	**61·02**	**106·93**	**·9059**	**55·45**	**63·28**	**110·92**
8	53·22	61·06	107·01	8	55·50	63·33	111·00
7	53·26	61·10	107·08	7	55·55	63·37	111·08
6	53·30	61·15	107·16	6	55·59	63·42	111·16
5	53·35	61·19	107·23	5	55·64	63·46	111·24
4	53·39	61·23	107·31	4	55·68	63·51	111·32
3	53·43	61·28	107·38	3	55·73	63·55	111·40
2	53·48	61·32	107·46	2	55·77	63·60	111·48
1	53·52	61·36	107·54	1	55·82	63·64	111·56
0	53·57	61·40	107·61	0	55·86	63·69	111·64
·9099	**53·61**	**61·45**	**107·69**	**·9049**	**55·91**	**63·73**	**111·71**
8	53·65	61·49	107·76	8	55·95	63·78	111·79
7	53·70	61·53	107·84	7	56·00	63·82	111·87
6	53·74	61·58	107·91	6	56·05	63·87	111·95
5	53·78	61·62	107·99	5	56·09	63·91	112·03
4	53·83	61·66	108·06	4	56·14	63·96	112·10
3	53·87	61·71	108·14	3	56·18	64·00	112·18
2	53·91	61·75	108·21	2	56·23	64·05	112·26
1	53·96	61·79	108·29	1	56·27	64·09	112·34
0	54·00	61·84	108·36	0	56·32	64·14	112·41
·9089	**54·05**	**61·88**	**108·45**	**·9039**	**56·36**	**64·18**	**112·49**
	54·10	61·93	108·53	8	56·41	64·22	112·57
–	54·14	61·98	108·62	7	56·45	64·27	112·64
6	54·19	62·03	108·70	6	56·50	64·31	112·72
5	54·24	62·07	108·78	5	56·55	64·36	112·80
4	54·29	62·12	108·87	4	56·59	64·40	112·87
3	54·33	62·17	108·95	3	56·64	64·45	112·95
2	54·38	62·22	109·03	2	56·68	64·49	113·03
1	54·43	62·26	109·12	1	56·73	64·54	113·11
0	54·48	62·31	109·20	0	56·77	64·58	113·18
·9079	**54·52**	**62·36**	**109·28**	**·9029**	**56·82**	**64·63**	**113·26**
8	54·57	62·41	109·37	8	56·86	64·67	113·34
7	54·62	62·45	109·45	7	56·91	64·71	113·41
6	54·67	62·50	109·53	6	56·95	64·76	113·49
5	54·71	62·55	109·62	5	57·00	64·80	113·57
4	54·76	62·60	109·70	4	57·04	64·85	113·64
3	54·81	62·65	109·78	3	57·08	64·89	113·71
2	54·86	62·69	109·87	2	57·13	64·93	113·78
1	54·90	62·74	109·95	1	57·17	64·97	113·85
0	*54·05*	62·79	110·03	0	57·21	65·01	113·92

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9019	**57·25**	**65·05**	**113·99**
8	57·29	65·09	114·06
7	57·33	65·13	114·13
6	57·38	65·17	114·20
5	57·42	65·21	114·27
4	57·46	65·25	114·34
3	57·50	65·29	114·41
2	57·54	65·33	114·48
1	57·58	65·37	114·55
0	57·63	65·41	114·62
·9009	**57·67**	**65·45**	**114·69**
8	57·71	65·49	114·76
7	57·75	65·53	114·83
6	57·79	65·57	114·90
5	57·83	65·61	114·97
4	57·88	65·65	115·04
3	57·92	65·69	115·11
2	57·96	65·73	115·18
1	58·00	65·77	115·26
0	58·05	65·81	115·33
·8999	**58·09**	**65·85**	**115·41**
8	58·14	65·90	115·49
7	58·18	65·94	115·57
6	58·23	65·99	115·64
5	58·27	66·03	115·72
4	58·32	66·07	115·80
3	58·36	66·12	115·87
2	58·41	66·16	115·95
1	58·45	66·21	116·03
0	58·50	66·25	116·11
·8989	**58·55**	**66·29**	**116·18**
8	58·59	66·34	116·26
7	58·64	66·38	116·34
6	58·68	66·43	116·42
5	58·73	66·47	116·49
4	58·77	66·51	116·57
3	58·82	66·56	116·65
2	58·86	66·60	116·72
1	58·91	66·65	116·80
0	58·95	66·69	116·88
·8979	**59·00**	**66·74**	**116·96**
8	59·04	66·78	117·03
7	59·09	66·82	117·11
6	59·13	66·86	117·17
5	59·17	66·90	117·25
4	59·22	66·94	117·32
3	59·26	66·99	117·39
2	59·30	67·03	117·47
1	59·35	67·07	117·54
0	59·39	67·11	117·61
·8969	**59·43**	**67·15**	**117·68**
8	59·48	67·19	117·76
7	59·52	67·24	117·83
6	59·57	67·28	117·90
5	59·61	67·32	117·98
4	59·65	67·36	118·05
3	59·70	67·40	118·12
2	59·74	67·44	118·20
1	59·78	67·49	118·27
0	59·83	67·53	118·34
·8959	**59·87**	**67·57**	**118·41**
8	59·91	67·61	118·49
7	59·96	67·65	118·56
6	60·00	67·69	118·63
5	60·04	67·73	118·70
4	60·08	67·77	118·77
3	60·13	67·81	118·84
2	60·17	67·85	118·91
1	60·21	67·89	118·98
0	60·26	67·93	119·05
·8949	**60·29**	**67·97**	**119·12**
8	60·33	68·01	119·18
7	60·38	68·05	119·25
6	60·42	68·09	119·32
5	60·46	68·13	119·39
4	60·50	68·17	119·46
3	60·54	68·21	119·53
2	60·58	68·25	119·60
1	60·63	68·29	119·67
0	60·67	68·33	119·74
·8939	**60·71**	**68·36**	**119·80**
8	60·76	68·40	119·87
7	60·79	68·44	119·94
6	60·83	68·48	120·01
5	60·88	68·52	120·08
4	60·92	68·56	120·15
3	60·96	68·60	120·22
2	61·00	68·64	120·29
1	61·04	68·68	120·35
0	61·08	68·72	120·42
·8929	**61·13**	**68·76**	**120·49**
8	61·17	68·80	120·56
7	61·21	68·83	120·63
6	61·25	68·87	120·70
5	61·29	68·91	120·77
4	61·33	68·95	120·83
3	61·38	68·99	120·90
2	61·42	69·03	120·97
1	61·46	69·07	121·04
0	61·50	69·11	121·11

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8919	61·54	69·15	121·18	·8869	63·74	71·22	124·80
8	61·58	69·19	121·24	8	63·78	71·26	124·87
7	61·63	69·22	121·31	7	63·83	71·30	124·94
6	61·67	69·26	121·38	6	63·87	71·34	125·02
5	61·71	69·30	121·45	5	63·91	71·38	125·09
4	61·75	69·34	121·52	4	63·96	71·42	125·16
3	61·79	69·38	121·59	3	64·00	71·46	125·23
2	61·83	69.42	121·66	2	64·04	71·50	125·30
1	61·88	69·46	121·72	1	64·09	71·54	125·38
0	61·92	69·50	121·79	0	64·13	71·58	125·44
·8909	61·96	69·54	121·86	·8859	64·17	71·62	125·51
8	62·00	69·58	121·93	8	64·22	71·66	125·58
7	62·05	69·62	122·01	7	64·26	71·70	125·65
6	62·09	69·66	122·08	6	64·30	71·74	125·72
5	62·14	69·71	122·16	5	64·35	71·78	125·79
4	62·18	69·75	122·23	4	64·39	71·82	125·86
3	62·23	69·79	122·31	3	64·43	71·86	125·93
2	62·27	69·84	122·38	2	64·48	71·90	126·01
1	62·32	69·88	122·46	1	64·52	71·94	126·08
0	62·36	69·92	122·53	0	64·57	71·98	126·15
·8899	62·41	69·96	122·61	·8849	64·61	72·02	126·22
8	62·45	70·01	122·68	8	64·65	72·06	126·29
7	62·50	70·05	122·76	7	64·70	72·10	126·36
6	62·55	70·09	122·84	6	64·74	72·14	126·43
5	62·59	70·14	122·91	5	64·78	72·18	126·50
4	62·64	70·18	122·99	4	64·83	72·22	126·57
3	62·68	70·22	123·06	3	64·87	72·26	126·64
2	62·73	70·27	123·14	2	64·91	72·30	126·71
1	62·77	70·31	123·21	1	64·96	72·34	126·78
0	62·82	70·35	123·29	0	65·00	72·38	126·85
·8889	62·86	70·40	123·36	·8839	65·04	72·42	126·92
8	62·91	70·44	123·44	8	65·08	72·46	126·99
7	62·95	70·48	123·52	7	65·13	72·50	127·05
6	63·00	70·52	123·59	6	65·17	72·54	127·12
5	63·04	70·57	123·66	5	65·21	72·58	127·19
4	63·09	70·61	123·73	4	65·25	72·61	127·25
3	63·13	70·65	123·80	3	65·29	72·65	127·32
2	63·17	70·69	123·88	2	65·33	72·69	127·39
1	63·22	70·73	123·95	1	65·38	72·73	127·45
0	63·26	70·77	124·02	0	65·42	72·77	127·52
·8879	63·30	70·81	124·09	·8829	65·46	72·80	127·59
8	63·35	70·85	124·16	8	65·50	72·84	127·65
7	63·39	70·89	124·23	7	65·54	72·88	127·72
6	63·43	70·93	124·30	6	65·58	72·92	127·79
5	63·48	70·97	124·37	5	65·63	72·96	127·85
4	63·52	71·01	124·44	4	65·67	72·99	127·92
3	63·57	71·05	124·52	3	65·71	73·03	127·99
2	63·61	71·09	124·59	2	65·75	73·07	128·05
1	63·65	71·13	124·66	1	65·79	73·11	128·12
0	63·70	71·17	124·73	0	65·83	73·15	128·19

Gravity 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8819	65·88	73·19	128·25	·8769	68·00	75·12	131·64
8	65·92	73·22	128·32	8	68·04	75·16	131·71
7	65·96	73·26	128·39	7	68·08	75·19	131·77
6	66·00	73·30	128·45	6	68·13	75·23	131·84
5	66·04	73·34	128·52	5	68·17	75·27	131·90
4	66·09	73·38	128·59	4	68·21	75·30	131·97
3	66·13	73·42	128·66	3	68·25	75·34	132·04
2	66·17	73·46	128·73	2	68·29	75·38	132·10
1	66·22	73·50	128·80	1	68·33	75·42	132·17
0	66·26	73·54	128·87	0	68·38	75·45	132·23
8809	66·30	73·57	128·94	·8759	68·42	75·49	132·30
8	66·35	73·61	129·01	8	68·46	75·53	132·36
7	66·39	73·65	129·08	7	68·50	75·57	132·43
6	66·43	73·69	129·15	6	68·54	75·60	132·49
5	66·48	73·73	129·22	5	68·58	75·64	132·56
4	66·52	73·77	129·29	4	68·63	75·68	132·63
3	66·57	73·81	129·36	3	68·67	75·72	132·69
2	66·61	73·85	129·43	2	68·71	75·75	132·76
1	66·65	73·89	129·50	1	68·75	75·79	132·82
0	66·70	73·93	129·57	0	68·79	75·83	132·89
8799	66·74	73·97	129·64	·8749	68·83	75·87	132·95
8	66·78	74·01	129·71	8	68·88	75·90	133·02
7	66·83	74·05	129·78	7	68·92	75·94	133·08
6	66·87	74·09	129·85	6	68·96	75·98	133·16
5	66·91	74·13	129·92	5	69·00	76·01	133·21
4	66·96	74·17	129·99	4	69·04	76·05	133·28
3	67·00	74·22	130·06	3	69·08	76·09	133·31
2	67·04	74·25	130·13	2	69·13	76·13	133·41
1	67·08	74·29	130·19	1	69·17	76·16	133·47
0	67·13	74·33	130·26	0	69·21	76·20	133·54
8789	67·17	74·37	130·33	·8739	69·25	76·24	133·60
8	67·21	74·40	130·39	8	69·29	76·27	133·67
7	67·25	74·44	130·46	7	69·33	76·31	133·73
6	67·29	74·48	130·52	6	69·38	76·35	133·80
5	67·33	74·52	130·59	5	69·42	76·39	133·86
4	67·38	74·55	130·66	4	69·46	76·42	133·93
3	67·42	74·59	130·72	3	69·50	76·46	133·99
2	67·46	74·63	130·79	2	69·54	76·50	134·06
1	67·50	74·67	130·85	1	69·58	76·53	134·12
0	67·54	74·70	130·92	0	69·63	76·57	134·19
8779	67·58	74·74	130·98	·8729	69·67	76·61	134·25
8	67·63	74·78	131·05	8	69·71	76·65	134·32
7	67·67	74·82	131·12	7	69·75	76·68	134·38
6	67·71	74·86	131·18	6	69·79	76·72	134·45
5	67·75	74·89	131·25	5	69·83	76·76	134·51
4	67·79	74·93	131·31	4	69·88	76·80	134·58
3	67·83	74·97	131·38	3	69·92	76·83	134·64
2	67·88	75·01	131·45	2	69·96	76·87	134·71
1	67·92	75·04	131·51	1	70·00	76·91	134·77
0	67·96	75·08	131·58	0	70·04	76·94	134·84

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C·	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8719	**70·08**	**76·98**	**134·90**	**·8669**	**72·13**	**78·77**	**138·05**
8	70·12	77·01	134·96	8	72·17	78·81	138·11
7	70·16	77·05	135·02	7	72·22	78·85	138·18
6	70·20	77·08	135·08	6	72·26	78·89	138·25
5	70·24	77·12	135·14	5	72·30	78·93	138·32
4	70·28	77·15	135·21	4	72·35	78·96	138·38
3	70·32	77·19	135·27	3	72·39	79·00	138·45
2	70·36	77·22	135·33	2	72·43	79·04	138·52
1	70·40	77·25	135·39	1	72·48	79·08	138·58
0	70·44	77·29	135·45	0	72·52	79·12	138·65
·8709	**70·48**	**77·32**	**135·51**	**·8659**	**72·57**	**79·16**	**138·72**
8	70·52	77·36	135·57	8	72·61	79·19	138·79
7	70·56	77·39	135·64	7	72·65	79·23	138·85
6	70·60	77·43	135·70	6	72·70	79·27	138·92
5	70·64	77·46	135·76	5	72·74	79·31	138·99
4	70·68	77·50	135·82	4	72·78	79·35	139·05
3	70·72	77·53	135·88	3	72·83	79·39	139·12
2	70·76	77·57	135·94	2	72·87	79·42	139·19
1	70·80	77·60	136·00	1	72·91	79·46	139·26
0	70·84	77·64	136·07	0	72·96	79·50	139·32
·8699	**70·88**	**77·67**	**136·13**	**·8649**	**73·00**	**79·54**	**139·39**
8	70·92	77·71	136·19	8	73·04	79·57	139·45
7	70·96	77·74	136·25	7	73·08	79·61	139·52
6	71·00	77·78	136·31	6	73·13	79·65	139·58
5	71·04	77·82	136·37	5	73·17	79·68	139·64
4	71·08	77·85	136·44	4	73·21	79·72	139·71
3	71·13	77·89	136·50	3	73·25	79·75	139·77
2	71·17	77·93	136·56	2	73·29	79·79	139·83
1	71·21	77·96	136·63	1	73·33	79·83	139·90
0	71·25	78·00	136·69	0	73·38	79·86	139·96
·8689	**71·29**	**78.04**	**136·76**	**·8639**	**73·42**	**79·90**	**140·02**
8	71·33	78·07	136·82	8	73·46	79·94	140·09
7	71·38	78·11	136·88	7	73·50	79·97	140·15
6	71·42	78·14	136·95	6	73·54	80·01	140·21
5	71·46	78·18	137·01	5	73·58	80·04	140·27
4	71·50	78·22	137·08	4	73·63	80·08	140·34
3	71·54	78·25	137·14	3	73·67	80·12	140·40
2	71·58	78·29	137·20	2	73·71	80·15	140·46
1	71·63	78·33	137·27	1	73·75	80·19	140·53
0	71·67	78·36	137·33	0	73·79	80·22	140·59
.8679	**71·71**	**78·40**	**137·40**	**·8629**	**73·83**	**80·26**	**140·65**
8	71·75	78·44	137·46	8	73·88	80·30	140·72
7	71·79	78·47	137·52	7	73·92	80·33	140·78
6	71·83	78·51	137·59	6	73·96	80·37	140·84
5	71·88	78·55	137·65	5	74·00	80·40	140·91
4	71·92	78·58	137·72	4	74·05	80·44	140·98
3	71·96	78·62	137·78	3	74·09	80·48	141·05
2	72·00	78·66	137·85	2	74·14	80·52	141·12
1	72·04	78·70	137·91	1	74·18	80·56	141·19
0	72·09	78·73	137·98	0	74·23	80·60	141·26

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8619	**74·27**	**80·64**	**141·33**
8	74·32	80·68	141·40
7	74·36	80·72	141·47
6	74·41	80·76	141·54
5	74·45	80·80	141·61
4	74·50	80·84	141·68
3	74·55	80·88	141·75
2	74·59	80·92	141·82
1	74·64	80·96	141·89
0	74·68	81·00	141·96
·8609	**74·73**	**81·04**	**142·03**
8	74·77	81·08	142·10
7	74·82	81·12	142·17
6	74·86	81·16	142·24
5	74·91	81·20	142·31
4	74·95	81·24	142·38
3	75·00	81·28	142·45
2	75·05	81·32	142·52
1	75·09	81·36	142·59
0	75·14	81·40	142·66
·8599	**75·18**	**81·44**	**142·73**
8	75·23	81·48	142·79
7	75·27	81·52	142·86
6	75·32	81·56	142·93
5	75·36	81·60	143·00
4	75·41	81·64	143·07
3	75·45	81·68	143·14
2	75·50	81·72	143·21
1	75·55	81·76	143·28
0	75·59	81·80	143·35
·8589	**75·64**	**81·84**	**143·42**
8	75·68	81·88	143·49
7	75·73	81·92	143·56
6	75·77	81·96	143·63
5	75·82	82·00	143·70
4	75·86	82·04	143·77
3	75·91	82·08	143·84
2	75·95	82·12	143·91
1	76·00	82·16	143·98
0	76·04	82·19	144·04
·8579	**76·08**	**82·23**	**144·10**
8	76·13	82·26	144·16
7	76·17	82·30	144·23
6	76·21	82·33	144·29
5	76·25	82·37	144·35
4	76·29	82·40	144·41
3	76·33	82·44	144·47
2	76·38	82·47	144·54
1	76·42	82·51	144·60
0	76·46	82·54	144·66
·8569	**76·50**	**82·58**	**144·72**
8	76·54	82·61	144·78
7	76·58	82·65	144·84
6	76·63	82·69	144·91
5	76·67	82·72	144·97
4	76·71	82·76	145·03
3	76·75	82·79	145·09
2	76·79	82·83	145·15
1	76·83	82·86	145·22
0	76·88	82·90	145·28
·8559	**76·92**	**82·93**	**145·34**
8	76·96	82·97	145·40
7	77·00	83·00	145·46
6	77·04	83·04	145·52
5	77·08	83·07	145·59
4	77·13	83·11	145·65
3	77·17	83·14	145·71
2	77·21	83·18	145·77
1	77·25	83·21	145·83
0	77·29	83·25	145·89
·8549	**77·33**	**83·28**	**145·96**
8	77·38	83·32	146·02
7	77·42	83·36	146·08
6	77·46	83·39	146·14
5	77·50	83·43	146·20
4	77·54	83·46	146·26
3	77·58	83·50	146·32
2	77.63	83·53	146·39
1	77·67	83·57	146·45
0	77·71	83·60	146·51
·8539	**77·75**	**83·64**	**146·57**
8	77·79	83·67	146·63
7	77·83	83·71	146 69
6	77·88	83·74	146·75
5	77·92	83·78	146·82
4	77·96	83·81	146·88
3	78·00	83·85	146·94
2	78·04	83·88	147·00
1	78·08	83·91	147·05
0	78·12	83·94	147·11
·8529	**78·16**	**83·98**	**147·17**
8	78·20	84·01	147·23
7	78·24	84·04	147·29
6	78·28	84·08	147·34
5	78·32	84·11	147·40
4	78·36	84·14	147·46
3	78·40	84·18	147·52
2	78·44	84·21	147·57
1	78·48	84·24	147·63
0	78·52	84·27	147·69

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8519	78·56	84·31	147·75	·8469	80·58	85·97	150·67
8	78·60	84·34	147·80	8	80·63	86·01	150·73
7	78·64	84·37	147·86	7	80·67	86·04	150·79
6	78·68	84·41	147·92	6	80·71	86·08	150·85
5	78·72	84·44	147·98	5	80·75	86·11	150·91
4	78·76	81·47	148·03	4	80·79	86·15	150·97
3	78·80	84·51	148·09	3	80·83	86·18	151·03
2	78·81	81.54	148·15	2	80·88	86·22	151·09
1	78·88	84·57	148·21	1	80·92	86·25	151·15
0	78·92	84·60	148·27	0	80·96	86·28	151·21
·8509	78·96	84·64	148·32	·8459	81·00	86·32	151·27
8	79·00	84·67	148·38	8	81·04	86·35	151·33
7	79·04	84·70	148·44	7	81·08	86·38	151·38
6	79·08	84·74	148·50	6	81·12	86·42	151·44
5	79·12	84·77	148·56	5	81·16	86·45	151·49
4	79·16	84·80	148·61	4	81·20	86·48	151·55
3	79·20	84·83	148·67	3	81·24	86·51	151·61
2	79·24	84·87	148·73	2	81·28	86·54	151·66
1	79·28	84·90	148·79	1	81·32	86·58	151·72
0	79·32	84·93	148·84	0	81·36	86·61	151·78
·8499	79·36	84·97	148·90	·8449	81·40	86·64	151·83
8	79·40	85·00	148·96	8	81·44	86·67	151·89
7	79·44	85·03	149·02	7	81·48	86·71	151·95
6	79·48	85·06	149·07	6	81·52	86·74	152·00
5	79·52	85·10	149·13	5	81·56	86·77	152·06
4	79·56	85·13	149·19	4	81·60	86·80	152·11
3	79·60	85·16	149·25	3	81·64	86·83	152·17
2	79·64	85·19	149·27	2	81·68	86·87	152·23
1	79·68	85·23	149·32	1	81·72	86·90	152·28
0	79·72	85·26	149·38	0	81·76	86·93	152·34
·8489	79·76	85·29	149·44	·8439	81·80	86·96	152·40
8	79·80	85·33	149·50	8	81·84	86·99	152·45
7	79·84	85·36	149·56	7	81·88	87·03	152·51
6	79·88	85·39	149·61	6	81·92	87·06	152·57
5	79·92	85·42	149·67	5	81·96	87·09	152·62
4	79·96	85·46	149·73	4	82·00	87·12	152·68
3	80·00	85·49	149·82	3	82·04	87·15	152·73
2	80·04	85·53	149·88	2	82·08	87·18	152·79
1	80·08	85·56	149·91	1	82·12	87·21	152·84
0	80·13	85·59	150·00	0	82·15	87·24	152·89
·8479	80·17	85·63	150·06	·8429	82.19	87·27	152·95
8	80·21	85·66	150·12	8	82·23	87·30	153·00
7	80·25	85·70	150·19	7	82·27	87·34	153·05
6	80·29	85·73	150·25	6	82·31	87·37	153·11
5	80·33	85·77	150·31	5	82·35	87·40	153·16
4	80·38	85·80	150·37	4	82·38	87·43	153·21
3	80·42	85·84	150·43	3	82·42	87·46	153·27
2	80·46	85·87	150·49	2	82·46	87·49	153·32
1	80·50	85·90	150·55	1	82·50	87·52	153·37
0	80·54	85·94	150·61	0	82·54	87·55	153·43

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8419	82·58	87·58	153·48	·8369	84·52	89·11	156·16
8	82·62	87·61	153·53	8	84·56	89·14	156·21
7	82·65	87·64	153·59	7	84·60	89·17	156·27
6	82·69	87·67	153·64	6	84·64	89·20	156·33
5	82·73	87·70	153·69	5	84·68	89·24	156·38
4	82·77	87·73	153·75	4	84·72	89·27	156·44
3	82·81	87·76	153·80	3	84·76	89·30	156·49
2	82·85	87·79	153·85	2	84·80	89·33	156·55
1	82·88	87·82	153·91	1	84·84	89·36	156·60
0	82·92	87·85	153·96	0	84·88	89·39	156·66
·8409	82·96	87·88	154·01	·8359	84·92	89·42	156·71
8	83·00	87·91	154·07	8	84·96	89·46	156·77
7	83·04	87·94	154·12	7	85·00	89·49	156·82
6	83·08	87·97	154·17	6	85·04	89·52	156·87
5	83·12	88·00	154·23	5	85·08	89·55	156·93
4	83·15	88·03	154·28	4	85·12	89·58	156·98
3	83·19	88·06	154·33	3	85·15	89·61	157·03
2	83·23	88·09	154·38	2	85·19	89·64	157·08
1	83·27	88·13	154·44	1	85·23	89·67	157·13
0	83·31	88·16	154·49	0	85·27	89·70	157·19
·8399	83·35	88·19	154·54	·8349	85·31	89·72	157·24
8	88·38	88·22	154·60	8	85·35	89·75	157·29
7	83·42	88·25	154·65	7	85·38	89·78	157·34
6	83·46	88·28	154·70	6	85·42	89·81	157·39
5	83·50	88·31	154·75	5	85·46	89·84	157·45
4	83·54	88·34	154·81	4	85·50	89·87	157·50
3	83·58	88·37	154·86	3	85·54	89·90	157·55
2	83·62	88·40	154·91	2	85·58	89·93	157·60
1	83·65	88·43	154·97	1	85·62	89·96	157·65
0	83·69	88·46	155·02	0	85·65	89·99	157·71
·8389	83·73	88·49	155·07	·8339	85·69	90·02	157·76
8	83·77	88·52	155·13	8	85·73	90·05	157·81
7	83·81	88·55	155·18	7	85·77	90·08	157·86
6	83·85	88·58	155·23	6	85·81	90·11	157·91
5	83·88	88·61	155·28	5	85·85	90·14	157·97
4	83·92	88·64	155·34	4	85·88	90·17	158·02
3	83·96	88·67	155·39	3	85·92	90·20	158·07
2	84·00	88·70	155·44	2	85·96	90·23	158·12
1	84·04	88·73	155·50	1	86·00	90·26	158·17
0	84·08	88·76	155·55	0	86·04	90·29	158·23
·8379	84·12	88·79	155·61	·8329	86·08	90·32	158·28
8	84·16	88·83	155·66	8	86·12	90·35	158·33
7	84·20	88·86	155·72	7	86·15	90·38	158·38
6	84·24	88·89	155·77	6	86·19	90·40	158·43
5	84·28	88·92	155·83	5	86·23	90·43	158·48
4	84·32	88·95	155·88	4	86·27	90·46	158·53
3	84·36	88·98	155·94	3	86·31	90·49	158·59
2	84·40	89·01	155·99	2	86·35	90·52	158·64
1	84·44	89·05	156·05	1	86·38	90·55	158·69
0	84·48	89·08	156·10	0	86·42	90·58	158·74

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C·	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit per cent.
·8319	86·46	90·61	158·79	·8269	88·40	92·08	161·37
8	86·50	90·64	158·84	8	88·44	92·12	161·43
7	86·54	90·67	158·90	7	88·48	92·15	161·48
6	86·58	90·70	158·95	6	88·52	92·18	161·53
5	86·62	90·73	159·00	5	88·56	92·21	161·59
4	86·65	90·76	159·05	4	88·60	92·24	161·64
3	86·69	90·79	159·10	3	88·64	92·27	161·70
2	86·73	90·82	159·15	2	88·68	92·30	161·75
1	86·77	90·85	159·20	1	88·72	92·33	161·80
0	86·81	90·88	159·26	0	88·76	92·36	161·86
·8309	86·85	90·90	159·31	·8259	88·80	92·39	161·91
8	86·88	90·93	159·36	8	88·84	92·42	161·96
7	86·92	90·96	159·41	7	88·88	93·45	162·02
6	86·96	90·99	159·46	6	88·92	92·48	162·07
5	87·00	91·02	159·51	5	88·96	92·51	162·12
4	87·04	91·05	159·57	4	89·00	92·54	162·18
3	87·08	91·08	159·62	3	89·04	92·57	162·23
2	87·12	91·11	159·67	2	89·08	92·60	162·28
1	87·15	91·14	159·72	1	89·12	92·63	162·33
0	87·19	91·17	159·77	0	89·16	92·66	162·38
·8299	87·23	91·20	159·82	·8249	89·19	92·68	162·43
8	87·27	91·23	159·87	8	89·23	92·71	162·48
7	87·31	91·25	159·92	7	89·27	92·74	162·53
6	87·35	91·28	159·97	6	89·31	92·77	162·58
5	87·38	91·31	160·02	5	89·35	92·80	162·63
4	87·42	91·34	160·08	4	89·38	92·83	162·68
3	87·46	91·37	160·13	3	89·42	92·86	162·73
2	87·50	91·40	160·18	2	89·46	92·89	162·78
1	87·54	91·43	160·23	1	89·50	92·91	162·83
0	87·58	91·46	160·28	0	89·54	92·94	162·88
·8289	87·62	91·49	160·33	·8239	89·58	92·97	162·93
8	87·65	91·52	160·38	8	89·62	93·00	162·98
7	87·69	91·55	160·43	7	89·65	93·03	163·03
6	87·73	91·57	160·48	6	89·69	93·06	163·08
5	87·77	91·60	160·53	5	89·73	93·09	163·13
4	87·81	91·63	160·59	4	89·77	93·11	163·18
3	87·85	91·66	160·64	3	89·81	93·14	163·23
2	87·88	91·69	160·69	2	89·85	93·17	163·28
1	87·92	91·72	160·74	1	89·88	93·20	163·33
0	87·96	91·75	160·79	0	89·92	93·23	163·38
·8279	88·00	91·78	160·84	·8229	89·96	93·26	163·4
8	88·04	91·81	160·89	8	90·00	93·29	163·48
7	88·08	91·84	160·95	7	90·04	93·31	163·53
6	88·12	91·87	161·00	6	90·07	93·34	163·57
5	88·16	91·90	161·05	5	90·11	93·36	163·62
4	88·20	91·93	161·11	4	90·14	93·39	163·66
3	88·24	91·96	161·16	3	90·18	93·41	163·70
2	88·28	91·99	161·21	2	90·21	93·44	163·75
1	88·32	92·02	161·27	1	90·25	93·47	163·79
0	*88·36*	92·05	161·32	0	90·29	93·49	168·84

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8219	90·32	93·52	163·88
8	90·36	93·54	163·93
7	90·39	93·57	163·97
6	90·43	93·59	164·02
5	90·46	93·62	164·06
4	90·50	93·64	164·11
3	90·54	93·67	164·15
2	90·57	93·70	164·20
1	90·61	93·72	164·24
0	90·64	93·75	164·29
·8209	90·68	93·77	164·33
8	90·71	93·80	164·38
7	90·75	93·82	164·42
6	90·79	93·85	164·47
5	90·82	93·87	164·51
4	90·86	93·90	164·56
3	90·89	93·93	164·60
2	90·93	93·95	164·65
1	90·96	93·98	164·69
0	91·00	94·00	164·74
·8199	91·04	94·03	164·78
8	91·07	94·05	164·83
7	91·11	94·08	164·87
6	91·14	94·10	164·91
5	91·18	94·13	164·96
4	81·21	94·15	165·00
3	91·25	94·18	165·05
2	91·29	94·21	165·09
1	91·32	94·23	165·14
0	91·36	94·26	165·18
·8189	91·39	94·28	165·23
8	91·43	94·31	165·27
7	91·46	94·33	165·31
6	91·50	94·36	165·36
5	91·54	94·38	165·40
4	91·57	94·41	165·45
3	91·61	94·43	165·49
2	91·64	94·46	165·54
1	91·68	94·48	165·58
0	91·71	94·51	165·62
·8179	91·75	94·53	165·67
8	91·79	94·56	165·71
7	91·82	94·59	165·76
6	91·86	94·61	165·80
5	91·89	94·64	165·85
4	91·93	94·66	165·89
3	91·96	94·69	165·94
2	92·00	94·71	165·98
1	92·04	94·74	166·03
0	92·07	94·76	166·07
·8169	92·11	94·79	166·12
8	92·15	94·82	166·17
7	92·18	94·84	166·21
6	92·22	94·87	166·26
5	92·26	94·90	166·30
4	92·30	94·92	166·35
3	92·33	94·95	166·40
2	92·37	94·98	166·44
1	92·41	95·00	166·49
0	92·44	95·03	166·53
·8159	92·48	95·06	166·58
8	92·52	95·08	166·63
7	92·55	95·11	166·67
6	92·59	95·13	166·72
5	92·63	95·16	166·76
4	92·67	95·19	166·81
3	92·70	95·21	166·86
2	92·74	95·24	166·90
1	92·78	95·27	166·95
0	92·81	95·29	167·00
·8149	92·85	95·32	167·04
8	92·89	95·35	167·09
7	92·92	95·37	167·13
6	92·96	95·40	167·18
5	93·00	95·42	167·23
4	93·04	95·45	167·27
3	93·07	95·48	167·32
2	93·11	95·50	167·36
1	93·15	95·53	167·41
0	93·18	95·55	167·46
·8139	93·22	95·58	167·50
8	93·26	95·61	167·55
7	93·30	95·63	167·59
6	93·33	95·66	167·64
5	93·37	95·69	167·69
4	93·41	95·71	167·73
3	93·44	95·74	167·78
2	93·48	95·76	167·82
1	93·52	95·79	167·87
0	93·55	95·82	167·92
·8129	93·59	95·84	167·96
8	93·63	95·87	168·01
7	93·67	95·90	168·05
6	93·70	95·92	168·10
5	93·74	95·95	168·15
4	93·78	95·97	168·19
3	93·81	96·00	168·24
2	93·85	96·03	168·28
1	93·89	96·05	168·33
0	93·92	96·08	168·38

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit per cent.
·8119	93·96	96·11	168·42	·8069	95·71	97·29	170·50
8	94·00	96·13	168·47	8	95·75	97·32	170·54
7	94·03	96·16	168·51	7	95·79	97·34	170·59
6	94·07	96·18	168·55	6	95·82	97·37	170·63
5	94·10	96·20	168·59	5	95·86	97·39	170·67
4	94·14	96·22	168·63	4	95·89	97·41	170·72
3	94·17	96·25	168·67	3	95·93	97·44	170·76
2	94·21	96·27	168·71	2	95·96	97·46	170·80
1	94·24	96·29	168·75	1	96·00	97·49	170·84
0	94·28	96·32	168·79	0	96·03	97·51	170·88
·8109	94·31	96·34	168·84	·8059	96·07	97·53	170·92
8	94·34	96·36	168·88	8	96·10	97·55	170·96
7	94·38	96·39	168·92	7	96·13	97·57	171·00
6	94·41	96·41	168·96	6	96·16	97·60	171·03
5	94·45	96·43	169·00	5	96·20	97·62	171·07
4	94·48	96·46	169·04	4	96·23	97·64	171·11
3	94·52	96·48	169·08	3	96·26	97·66	171·15
2	94·55	96·50	169·12	2	96·30	97·68	171·19
1	94·59	96·53	169·16	1	96·33	97·70	171·22
0	94·62	96·55	169·20	0	96·37	97·73	171·26
·8099	94·66	96·57	169·24	·8049	96·40	97·75	171·30
8	94·69	96·60	169·28	8	96·43	97·77	171·34
7	94·73	96·62	169·32	7	96·46	97·79	171·37
6	94·76	96·64	169·36	6	96·50	97·81	171·41
5	94·80	96·67	169·40	5	96·53	97·83	171·45
4	94·83	96·69	169·44	4	96·57	97·86	171·49
3	94·86	96·71	169·48	3	96·60	97·88	171·53
2	94·90	96·74	169·52	2	96·63	97·90	171·56
1	94·93	96·76	169·57	1	96·66	97·92	171·60
0	94·97	96·78	169·61	0	96·70	97·94	171·64
·8089	95·00	96·80	169·65	·8039	96·73	97·96	171·68
8	95·04	96·83	169·69	8	96·76	97·98	171·72
7	95·07	96·85	169·73	7	96·80	98·01	171·75
6	95·11	96·88	169·78	6	96·83	98·03	171·79
5	95·14	96·90	169·82	5	96·87	98·05	171·83
4	95·18	96·93	169·86	4	96·90	98·07	171·87
3	95·21	96·95	169·90	3	96·93	98·09	171·91
2	95·25	96·98	169·95	2	96·96	98·11	171·94
1	95·29	97·00	169·99	1	97·00	98·14	171·98
0	95·32	97·02	170·03	0	97·03	98·16	172·02
·8079	95·36	97·05	170·07	·8029	97·07	98·18	172·05
8	95·39	97·07	170·12	8	97·10	98·20	172·09
7	95·43	97·10	170·16	7	97·13	98·22	172·13
6	95·46	97·12	170·20	6	97·16	98·24	172·17
5	95·50	97·15	170·25	5	97·20	98·27	172·20
4	95·54	97·17	170·29	4	97·23	98·29	172·24
3	95·57	97·20	170·33	3	97·26	98·31	172·28
2	95·61	97·22	170·37	2	97·30	98·33	172·32
1	95·64	97·24	170·42	1	97·33	98·35	172·35
0	*95·68*	97·27	170·46	0	97·37	98·37	172·39

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8019	97·40	98·39	172·43	·7969	99·00	99·37	174·17
8	97·43	98·42	172·47	8	99·03	99·39	174·21
7	97·46	98·44	172·50	7	99·06	99·41	174·24
6	97·50	98·46	172·54	6	99·10	99·43	174·28
5	97·53	98·48	172·58	5	99·13	99·45	174·31
4	97·57	98·50	172·62	4	99·16	99·47	174·35
3	97·60	98·52	172·65	3	99·19	99·49	174·38
2	97·63	98·54	172·69	2	99·23	99·51	174·42
1	97·66	98·56	172·73	1	99·26	99·53	174·45
0	97·70	98·59	172·77	0	99·29	99·55	174·49
·8009	97·73	98·61	172·80	·7959	99·32	99·57	174·52
8	97·76	98·63	172·84	8	99·36	99·59	174·55
7	97·80	98·65	172·88	7	99·39	99·61	174·59
6	97·83	98·67	172·92	6	99·42	99·63	174·62
5	97·87	98·69	172·95	5	99·45	99·65	174·66
4	97·90	98·71	172·99	4	99·48	99·67	174·69
3	97·93	98·74	173·03	3	99·52	99·69	174·73
2	97·96	98·76	173·07	2	99·55	99·71	174·76
1	98·00	98·78	173·10	1	99·58	99·73	174·80
0	98·03	98·80	173·14	0	99·61	99·75	174·83
·7999	98·06	98·82	173·17	·7949	99·65	99·77	174·87
8	98·09	98·83	173·20	8	99·68	99·80	174·90
7	98·12	98·85	173·24	7	99·71	99·82	174·94
6	98·16	98·87	173·27	6	99·74	99·84	174·97
5	98·19	98·89	173·30	5	99·78	99·86	175·01
4	98·22	98·91	173·34	4	99·81	99·88	175·04
3	98·25	98·93	173·37	3	99·84	99·90	175·08
2	98·28	98·94	173·40	2	99·87	99·92	175·11
1	98·31	98·96	173·44	1	99·90	99·94	175·15
0	98·34	98·98	173·47	0	99·94	99·96	175·18
·7989	98·37	99·00	173·50	·7939	99·97	99·98	175·22
8	98·41	99·02	173·54		Absolute	Alcohol.	
7	98·44	99·04	173·57	·7938	100·00	100·00	175·25
6	98·47	99·05	173·60				
5	98·50	99·07	173·64				
4	98·53	99·09	173·67				
3	98·56	99·11	173·71				
2	98·59	99·13	173·74				
1	98·62	99·15	173·77				
0	98·66	99·16	173·81				
·7979	98·69	99·18	173·84				
8	98·72	99·20	173·87				
7	98·75	99·22	173·91				
6	98·78	99·24	173·94				
5	98·81	99·26	173·97				
4	98·84	99·27	174·01				
3	98·87	99·29	174·04				
2	98·91	99·31	174·07				
1	98·94	99·33	174·11				
0	98·97	99·35	174·14				

MANUFACTURE OF CITRIC ACID.

By J. Carter Bell, F.C.S.

Read before the Society of Public Analysts, on 14th April, 1880.

The following paper is written, not from theoretical but practical knowledge. For some time I have been engaged with experiments upon citric acid, with the view of lessening the great loss which occurs during the process of manufacture—a manufacture which I have been obliged to abandon, owing to the great care which is required in the work, and not having had the time which is requisite for such a delicate chemical process. It is not often that authors record their failures in print; I do so now as a warning to those who may feel inclined to embark in similar enterprises. After finding my workmen had destroyed and wasted many gallons of liquor, I thought it was time to hand over the works to one who could give his sole attention to them.

Buying the Lemon Juice. A novice in the trade may lose a large sum at starting by not knowing how to buy the juice, for it seems the custom is to buy the juice by the old English gallon, and three pipes which were sent to the works were described in the invoice as containing 130 gallons in each pipe, whereas, when they were measured the quantity was found to be only 108 imperial gallons. Some Liverpool merchants very much wished to sell me 10 pipes of juice, each gallon to contain 64 ounces of crystallised citric acid. I agreed to take them if each pipe contained 130 English imperial gallons, and each gallon to contain 64 ounces of crystallised citric acid, English weight; they declined to execute the order, saying that the juice was sold according to the old English measure. The juice, which is generally concentrated before it arrives in this country, contains about four pounds of citric acid in each gallon; I have had it as high as six pounds to the gallon. The appearance of the juice is like thin black treacle, and on dilution with water a considerable quantity of organic matter is precipitated.

The following description is for working up two pipes of juice at the same time, for the labour is nearly the same as for one :—

A cistern must be provided capable of holding twelve hundred gallons: into this two pipes of juice are put, diluted with eight pipes of water, the colder the water is for this purpose the better, because the flocculent matter, which separates on dilution, is partially redissolved on warming. To allow this to settle, the solution must be allowed to stand for a day or two. Weak liquor should never be kept too long as it has a tendency to decompose. When the solution is clear it can be drawn off and allowed to flow through a sugar-bag or filter. These bags are made in Manchester, without seam, specially for the sugar makers; they are about six feet long and one in diameter. When the liquor has all passed through the bag, the solution may now be boiled up by means of steam blown into it at about 10 pounds pressure; when the liquor boils, fine whitening, which must be practically free from alumina, iron, and magnesia, is thrown in by small quantities at a time. Great care must be exercised that no lumps are introduced into the liquor, for they will fall to the bottom and thus a large excess of chalk may be used; it is advisable to mix the chalk with water, to the consistence of cream, or rather thicker, and pour the mixture in very gradually, taking great care that the contents of the vat do not overflow. The lime carbonate must be most accurately weighed, as the quantity of sulphuric acid necessary to decompose the citrate of lime can then be calculated. My practice was to estimate the amount of citric acid in the juice, and then, after analysing the chalk, calculate the amount which was required; when all the chalk has been added, the mixture must be boiled for half an hour, agitating the whole time. The citrate of lime is now allowed to settle; the supernatant liquor, if found free from citric acid, is run off; and for this purpose two holes may be made in the vat, one just above the citrate of lime deposit, and another six inches above. Notice must be taken where the citrate of lime rises to, as this will be the same in all cases if the same quantity and strength of juice be used; these holes may have gun-metal taps in them, or tubes with india-rubber and a clip. If taps are not convenient, have a large syphon; anything so that it will run the water off quickly. The object to be gained is to wash the citrate of lime as speedily as possible. Near this vat must be placed a citrate of lime washer, which consists of a frame made of wood, about six to eight inches deep, having a wooden bottom perforated with holes a quarter of an inch in diameter, and it is rather important that there should be no corners to this frame, therefore they must be curved off; if there are corners the citrate of lime is apt to lodge in them and decompose.

The citrate of lime washer must be made large enough to hold the one charge of citrate of lime: the size necessary can easily be calculated by noticing the depth of citrate of lime in the washing vat. The depth of the citrate of lime upon this washer should not exceed four inches. A piece of unbleached calico, rather larger than the bed of the washer, must now be spread smoothly over the bottom, and just allowed to overhang the sides. The supernatant liquor of the citrate of lime is now run upon the calico filter, in order to arrest any particles of citrate of lime. About one hundred gallons of hot water is poured upon the citrate of lime, well agitated, then allowed to settle and run off as before, while hot, because the citrate of lime is more soluble in cold water than hot. Repeat this two or three times, then run the citrate of lime on to the washer with sufficient water to make it flow easily. When all the liquor has drained away, the surface of the citrate of lime must be beaten all over with a little wooden pallet to prevent any cracks forming. When this is done give the citrate of lime a final wash with cold water about an inch in depth. The time required for washing this citrate of lime may vary almost in every case, as it depends very much upon the state of the citrate of lime; if it has a crystalline appearance, the easier it will be to wash; thus the time may vary from one to three days. Three days is a very extreme case. In summer it will require more time than winter, and also decomposes sooner. The citrate of lime in draining is very liable to form cracks upon the surface, and when water is poured, it would easily run through, without properly washing the citrate of lime, therefore the surface must be broken up.

There is no doubt that the tediousness of this washing would be much shortened by using a filter press.

When the citrate of lime has been well washed it must be taken out of the drainer and put into about one hundred and fifty gallons of cold water, this water must be in a tub with an agitator. When all the citrate of lime has been added, then put in brown oil of vitriol about 140° Twaddle, one per cent. in excess of the equivalent of carbonate of lime, but not more than one and a half per cent. Great care must be used in adding this acid; it must be weighed. When all the sulphuric acid has been added, agitate for an hour. The mixture will not require warming, as the heat generated by the addition of the sulphuric acid will be sufficient for the decomposition of the citrate of lime. When the agitation is finished, let the contents of the tub run on at once to the washer previously described.

The washing of the sulphate of lime requires great care. You must continue washing till the filtrates are no longer acid to the taste, or only slightly so. No certain rule can be laid down, as the number of washings may vary in each case. The last two or three washes may be used for the dilution of the crude juice. At each wash let the surface be covered with one inch of water, and before the new waters go on the sulphate of lime must be well drained each time, and between each wash the surface of the sulphate of lime must be well agitated, or cracks may be formed in the partially dry mass, which will allow the water to run through without percolating the whole of it. The cake of sulphate of lime should not be thicker than from four to five inches, and a similar filter may be used as in the washing of the citrate of lime. The free sulphuric acid in the juice will very soon rot the calico filters; therefore, perhaps, it would be more advisable to use a flannel for filtering. In washing the sulphate of lime it is better to use a small quantity of water each time, and a greater number of washes. The weak solution of citric acid is now run into a leaden evaporator. This may consist of a wooden box lined with lead. Into this must be put square tiles, and the best to use for this purpose are the tiles used in kilns for malt drying: they are perforated with very small holes. These must be put into the leaden tray, so as to present a perfectly flat surface. These are to be covered with water, and then a leaden evaporator will rest upon these tiles, being about one inch higher all round than the water-bath, as this will prevent the condensed water finding its way into the citric acid. On each side of the evaporator a steam pipe must be placed, capable of blowing steam into the water, and heating it to a certain temperature; also an overflow pipe, to carry away the condensed water. This evaporator should be nine inches deep, and it is better to make the sides square, and not sloping. The size of this evaporator must be in proportion to the quantity of liquor there is to evaporate down. When the weak acid is in the evaporator it must be evaporated down as quickly as possible at a temperature of 150° F., but not exceeding 160° F. When the acid is evaporated down to between 50° and 60° Twaddle, most of the sulphate of lime will have been precipitated. At this point it is better to syphon it off into another evaporator which stands at a lower level, and complete the evaporation in the second vessel. The evaporation must be carried on till a very slight film is observed upon the surface. The liquor must now be syphoned off into the crystallising trays. These vessels should be about six feet long, two feet wide, and six inches deep; these must be lined with nine pound lead. These solutions should stand about two days, and be covered to prevent dust falling in. At the end of two days good brown crystals should be obtained. The mother liquors must be evaporated, and a distinct pellicle must be formed before the steam is turned off. This liquor can now be run into the crystallisers.

It is very important that the mother liquors should never be mixed with original liquors, as the crystals from the mother liquors will be of a darker colour than from the original liquors.

Take the brown crystals—say four to five pounds of crystals to one gallon of water, dissolve, and boil with animal charcoal, which has been deprived of its lime salts by hydrochloric acid (about one pound of charcoal to one hundredweight of crystals) in a leaden-lined tub with steam blowing in; stir with a paddle the whole time, and boil for about twenty minutes. This solution must be filtered into leaden perforated cones, the top being about 18 inches square; calico is put into the leaden filters, and the filtrate is allowed to fall into a leaden vessel. This filtered solution must go into an evaporator kept solely for the purpose for white liquor, and evaporate at the same temperature as before. Now run off into the same crystallising vessels, and cover them with wooden covers. These crystallisers should not be in a cold place, say about 60° F. Let these stand from two to four days. The mother liquor might go back into the white evaporator. Let the market crystals drain; dig them out with a copper spud, and take them to a butterman's table, break them up slightly, and water them with a watering can. Take them to a stove and dry at about 80° F., on shallow trays, one inch deep, and about two feet square.

ON THE ACTION OF ALUM IN BREAD-MAKING.

By J. West-Knights, F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

To satisfy myself of the injurious action of alum in bread-making, I undertook the following experiments, the objects of which were chiefly to compare the digestibility of gluten—with and without alum—in an artificially prepared gastric juice. The results of my experiments, I think, will not be altogether uninteresting to Public Analysts at large.

The object of the baker in using alum seems to be a question upon which there are many opinions. It is frequently stated that it enables the bread to hold a larger quantity of water; this I undoubtedly consider a mistake, as I have estimated the moisture in all samples of bread that have passed through my hands, and have found on the average, no difference in moisture whatever, between pure and alumed bread; but I am inclined to think that it may cause bread, when first drawn from the oven, to have more water, as it is well known amongst bakers that alumed bread can be drawn 10 or 12 minutes sooner than pure bread; but this excess of moisture the bread does not retain.

The supposition has, no doubt, arisen from the fact, that gluten prepared (by washing) from alumed flour, retains, after working up in the hand and squeezing, considerably more moisture than that from pure flour, which excess of water separates shortly afterwards on standing. Alum is also said to save labour in the kneading of the dough, and so be an inducement for the workman to use it against the knowledge and consent of his master; how far this is correct I am unable to say. It seems certain, however, that the action of alum on flour that has become unsound, by fermentation that has been induced by dampness or heat, is to arrest the change, by destroying or arresting the action of the ferment, so that an apparently sound loaf can be produced from unsound flour. But if alum arrests the fermentation, and there can be little doubt that it does so, will it not act in the same way with the ferments of the saliva and gastric juice?

To test this question, I prepared some gluten with pure wheat flour, and weighed four portions of two grammes each, which were treated as follows:—

I. was boiled ten minutes in pure distilled water.

II. was boiled ten minutes in a weak solution of alum.

III. was boiled ten minutes in weak alum and carbonate of soda solutions, with the resulting precipitate of hydrate of alumina.

IV. was boiled ten minutes in weak alum and phosphate of soda solutions, and the resulting precipitate of phosphate of alumina.

Each sample, after washing with water, was digested in 50 c.c. of an artificial gastric juice (consisting of pepsin and 0·2 per cent. hydrochloric acid), at a temperature of from 90° to 96° F.; after five hours digestion, the residues that remained were removed, gently washed with distilled water, dried and weighed.

I. had entirely disappeared.

II. A tough spongy residue remained, which weighed 1·05 grammes.

III. A similar residue remained, which weighed 0·90 grammes.

IV. A similar residue, weighing 0·80 grammes.

These experiments have been repeated, using lactic acid instead of hydrochloric, with similar results.

I think the inference can fairly be drawn from these results, that gluten, after treatment with alum, or insoluble salts of alumina, is less soluble than ordinary gluten, in the gastric juice, by about one-half. Whether the alumina is in a soluble or insoluble form seems to have no great influence on its effects upon the gluten.

I next compared the digestibility of pure and alumed bread. The samples employed were:—

V. Pure bread made with yeast.

VI. Bread made with same flour as above, and "Alum Baking Powder" (containing about 30 per cent. of alum), in the proportion of a teaspoonful of baking powder to a pound of flour.

Two grammes of crumb in each case were taken, in its natural state of moisture.

After six hours digestion in 50 c.c. of gastric juice at 90° to 96° F., the residues in each case were collected, washed, dried and weighed, with the following results:—

V. Residue weighed 0·40 grammes.

VI. Residue weighed 0·66 grammes.

If 40 be taken as the average percentage of moisture in bread, and that percentage deducted from the two grammes originally taken, it leaves 1·2 grammes of dry bread operated upon, of which, in the pure sample, 0·80 grammes, corresponding to 66 per cent. was dissolved; and in the alumed bread 0·54 grammes, or 45 per cent. only.

Or, in other words, the pure bread was one-third more soluble in the gastric juice than the bread containing the "Alum Baking Powder."

I next tried the action of alum upon diastase.

Two separate grammes of crushed malt were weighed, and to one was added 0·1 grammes of crystallized alum; both samples were then digested with 20 c.c. of water at a temperature of 160° F., and maintained at that temperature half-an-hour, then filtered, and the residues washed with cold distilled water.

The pure sample gave 0·70 grammes of extract.

The sample containing alum gave 0·185 grammes only of extract, including the alum added, or that portion of it that was not retained in the residue. A considerable portion of the alum was in the extract, and no doubt a very much smaller quantity would have had the same effect.

This experiment shows that alum exerts a very marked influence on the conversion of starch by diastase; as diastase is similar in its action to, and supposed to be identical with, ptyalin, the ferment of the saliva, I think this has a direct bearing upon the indigestibility of alumed bread; for not only is the gluten of the bread but also the starch rendered much more indigestible by the presence of alum.

This powerful action of mere traces of alum or salts of alumina upon soluble gluten and diastase is, I think, sufficient foundation upon which to assert that alum, either in a soluble form or mixed with carbonate of soda, is injurious to health when introduced into bread: the extent of the injury may or may not be small.

THE WORK DONE BY PUBLIC ANALYSTS DURING 1879 UNDER THE SALE OF FOOD AND DRUGS ACT.

We are now preparing our Annual Tabulated Statement, which has always been received with so much interest, not only by the profession, but by Members of Parliament and the public at large. In order to obtain the necessary particulars, we have prepared a short and concise form of Return, copies of which have been sent to nearly every Public Analyst in the kingdom. To any Public Analyst who has not received one we shall be pleased to send a copy on having a post card from him. As the tabulating the returns involves a considerable expenditure of time, and it is desired to publish the table in our April number, we should be glad to receive the forms filled up by the 17th inst.

ANALYSTS' REPORTS.

Mr. W. W. Stoddart, Analyst for Somersetshire, in his report, states that he had during the quarter examined 177 samples of food, &c., of which 174 were brought by the police and three by the general public. Of these 13 were adulterated. During the past year he had made 802 analyses, many of them of great intricacy, and 54 of the samples were adulterated.

Mr. J. Carter Bell, Public Analyst for Cheshire, reports that during the quarter ended December 31st, 1879, he had examined 232 samples. Of these 29 were adulterated—namely, six whiskies, five gins, one brandy, seven coffees, two paregoric, five milks, and two mustards. 38 samples came from Hyde, 34 from Middlewich, 29 Broxton, 19 Eddisbury, 17 Wirral, 15 Altrincham, 14 Nantwich, 13 Runcorn, 12 Stockport, and nine Macclesfield. Owing to the energetic measures taken by Captain Arrowsmith, who had caused samples of milk to be taken from every division of the county, the quality of the milk supply has been excellent. By dividing the milk into three classes they obtained a ready means of comparison. First-class includes all milks whose numbers range from 93 to 100, and which milk could only be procured from cows which are in health, and properly fed and cared for. Second-class includes milk from cows which are not so well fed, and therefore cannot be in such good condition as the first. Third-class includes all adulterated samples, and milk from half-starved cows. There were some farmers who prided themselves on the fine condition in which they kept their cows, for their stock was well fed with the best food, and the shippons were kept in a clean state. The milk obtained from such a farm would rise above the first standard, and he proposed to call such milk extra first-class. There had been this quarter 48 milks extra first-class, 28 first-class, 10 second-class, and 13 third-class. The Analyst thought it would be wise now that in each division a record is kept of the number of milk dealers, to register the class to which the dealer belongs, and any farmer could then know how his milk was classed, and it would be an incentive to him to try and improve the quality, which could easily be done by ordinary care and attention. He would again press upon the notice of the Court the urgent necessity of having all water used for domestic purposes carefully examined, for upon several occasions he had found such water to be nearly diluted sewage, and highly dangerous. This remark applied not only to the poorer classes, but also to the wealthier, as one of the worst samples he had received came from a Cheshire mansion. The total number of samples analysed in the year 1879 had been 687; of these 134 had been adulterated.

Mr. Carter Bell, Analyst for Salford, reports that during the quarter ended December 31st, 1879, 124 samples had been analysed. The total number analysed for the year 1879 was 527. Of these 73 were adulterated, namely: 49 milks, eight breads, one port wine, four unfermented wines, two coffees, two sweet spirits of nitre, five butters, one whisky, and one cocoa. The greater number of the milks were adulterated with water from 10 to 20 per cent. One reached the high number of 35 per cent. It will be interesting to show how the quality of the milk has improved since the appointment of a Public Analyst. In the year 1874, 96 per cent. of the samples were adulterated; in 1875, 52 per cent; in 1876, 45 per cent.; in 1877, 38 per cent.; in 1878, 27 per cent.; and in 1879, 16 per cent. The samples of unfermented wines call for some attention. These were bought supposing them to be pure juice of the grape. Two shillings and sixpence a bottle was charged. The analysis of these so-called wines proved them to consist of nothing else but sugar, water, tartaric acid, and a little flavouring and colouring matter; and, in his opinion, worth as many pence as shillings were paid for them. One of the samples of unfermented wine bought from another maker was really what it professed to be—pure juice of the grape, mixed with a small quantity of sugar.

LAW REPORTS.

Potato Starch in Yeast held to be no Adulteration:—

At York, W. Appleton was summoned for having sold half-a-pound of German yeast, not of the nature, substance, and quality demanded. Inspector Farrah deposed to visiting defendant's shop and asking for half-a-pound of Dutch yeast. He was informed that there were only French and German yeasts in stock. He purchased half-a-pound of the latter, and declared that his purpose was to have it analysed. Dividing it into three parts, he gave one part to the defendant, kept one part himself, and sent the third to Mr. Baynes, the East Riding Analyst, for examination. The certificate of the latter gentleman declared the yeast to be adulterated with 35 per cent. of potato starch. Defendant pleaded that he had bought the yeast for pure, and that he had neither the means nor the intention of adulterating it. Major Bower, chief constable, suggested that the defendant should get a warranty from the wholesale dealer, but Mr. Holtby (magistrates' clerk) doubted the necessity of this. Between the magistrates and their clerk some discussion took place, the latter observing that the yeast was made from the refuse of gin, and so prepared that it could be imported into this country in bulk. One of the magistrates said that, to his mind, the potato starch had been added in order that the yeast might be brought over in a solid state. The Clerk thought it was unfair to say that the yeast had been adulterated by the use of potato starch. If anything deleterious had been found in the yeast it would have been an offence. A magistrate: It says "adulterated." The Clerk: I don't think potato starch is an adulteration. The Bench considered that no adulteration had taken place, and dismissed the case.

Unfermented Wine.—No standard of what Grape Juice it should contain:—

At the Salford Borough Police Court, before the stipendiary magistrate (Mr. J. Makinson), William Pilling, chemist and druggist, New Bailey Street, was summoned for having sold "to the prejudice of the purchaser, one bottle of unfermented port wine, which was not of the nature, substance, and quality of the article demanded." Another summons charged the defendant with selling similarly a bottle of unfermented sherry. Mr. J. C. Walker, assistant town clerk, appeared on behalf of the prosecution, and Mr. W. S. Sebright Green, solicitor, of Liverpool, represented the manufacturers, Messrs. Bell and Company, Liverpool. It appeared that on the 22nd of November, the inspector obtained at the defendant's shop a bottle of liquid labelled "unfermented port wine, manufactured from the juice of the grape, for sacramental and other purposes." He also obtained a bottle labelled "sherry," together with the rest of the above description. For these bottles he paid half-a-crown each. He left a sample of each bottle with the defendant, and submitted some of each to the Borough Analyst. Mr. J. Carter Bell, the analyst for the borough, was called, and stated that he received the samples in question on the 23rd November, and analysed them. He found in them no trace of the juice of the grape. The pure juice of the grape contained in a thousand parts three parts of ash, and that ash should consist mainly of potash, phosphoric acid, and other elements. About 90 per cent. of this ash should be soluble in water. With reference to the "unfermented sherry wine" which he had analysed, he only found ·190 of ash, which was considerably less than one-tenth of what ought to be found in pure grape juice. This ash contained a trace of potash and a trace of phosphoric acid. It consisted chiefly of sulphate of sodium, and calcium, with a few other mineral ingredients. 52 per cent. of it was only soluble in water. This was no more ash than could be got from ordinary drinking-water. In answer to the Bench, the witness said the sherry wine contained about 6-10ths per cent. of tartaric acid and about 22 per cent. of sugar. He considered that this so-called sherry wine was nothing more than a solution of sugar and tartaric acid, flavoured and coloured, and contained in a little salycylic acid. The port wine was very similar to the sherry. He was prepared to say that the wine was not manufactured as stated on the label from the pure juice of the grape. Cross-examined: He would not take his oath there was not some percentage of the juice of the grape in the compound, but he should think there was not 10 per cent. of grape juice in it. He would not swear that. He could not distinguish any grape sugar in it. For the defence it was contended that what was sold to the inspector as unfermented wine was sold without the slightest deception. It was not sold as pure juice of the grape. It was sold as manufactured from the pure juice of the grape. Pure juice of the grape would not keep without being mixed with other substances. The inspector did not ask for pure grape juice, and did not get it, but asked for unfermented wine manufactured from the juice of the grape, and got it. There were other materials used, but it was manufactured mainly from the juice of the grape. Mr. Green called attention to the fact that orange wine had not a particle of orange juice in it. He did not say this unfermented wine was proper for sacramental purposes, but he would show that it was produced from the juice of the grape. William Pilling, the defendant, was called. He said he had some customers for the wine, though not very many. *His assistant*, Jos. Littlewood, said he remembered supplying the inspector with the wine. He had sold it to a number of persons. G. B. Bell, one of the firm manufacturing the wine, stated that it was manufactured in large quantities. It was made from grapes, both black and white. The principal ingredient was grape juice. They had 3,284 wholesale customers at the present time. Cross-examined: They had dealt in the wine for about eight years, and they had had customers in Bradford for four or five years. Mr. J. Houston, manager for Messrs. Bell, said it was his business to manufacture the wine in question. With some reluctance, the witness stated that the process of manufacture was to preserve the grape juice with salycylic acid. To five parts of water he generally put one part of grape juice. To six gallons of this liquid was added two pounds of sugar. Mr. Louis Siebold, F.C.S., &c., said he had examined one of the samples of the wine in question. The predominant constituent of it was sugar, precisely the same as was contained in grapes. He also found tartaric acid exactly the same as was found in grapes. He found the constituents of grape juice present, but whether grapes or separate materials had been used he could not say, chemistry could not decide. His personal opinion was that something like ten per cent. of grape juice was used in the wine. Mr. Makinson, in dismissing the summons, said that there was no standard of what grape juice the wine should contain, and it could not be said that the manufacturers had fraudulently made this wine from water, for there was evidence that some proportion of grape juice was used. The defendant was allowed costs.

Decomposed Vinegar.—Vinegar Eels not Injurious:—

At the Droxford (Hants) Petty Sessions, Mr. Benjamin Boghurst was summoned for selling adulterated vinegar. A constable went to the defendant's shop and asked for a pint of vinegar. Mrs. Boghurst said she did not think she could draw so much, but managed to do so, and the payment of 3d. concluded the purchase. Mr. Arthur Angell, the County Analyst, said the vinegar was found to contain 3·9 per cent. of acetic acid, dead insects, organic matter, and vinegar eels. It was turbid and filthy, and swarmed with microscopic organisms. In his opinion it was not fit for food. In reply to Mr. Bullen, barrister-at-law, who defended, Mr. Angell said the liquid was of the substance of vinegar, but he could not swear that it was malt vinegar. There was no difference between the acetic acid of either malt vinegar or wood vinegar. He could not say that the vinegar eels were injurious to health. In defence, Mr. Bullen said his client had purchased the vinegar from a well-known firm at Winchester, who had received it from Messrs. Grimble & Co., of London. Both the defendant and Mr. Aylward, of Winchester, were called to give evidence, and both denied that the vinegar had been adulterated, and the head of the firm of Grimble & Co. said they occasionally obtained the assistance of Dr. Graham to analyse the vinegar. Professor Vöelcker proved on oath that the vinegar contained 4·22 per cent. of acetic acid. He did not find it in any microscopic organisms, only vinegar eels. It was of pleasant taste and odour, and was not decomposed. The vinegar eels were not injurious, as they were generated and nourished in brown vinegar. Although the sample was not so bright as he should like to use, it was free from adulteration. Professor Graham also proved that the vinegar was fit for food, and the bench dismissed the case.

Alum in Bread.—Can Alum be detected by the Taste or the Microscope?—

On February 16th, at Eckington Sessions, an important case was heard. George Widdowson, miller, Eckington, was summoned under the Act, for selling flour, not of the nature and substance and quality of the article demanded by the purchaser. Mr. Binney appeared for the prosecution, and Mr. Barker was for the defence. Mr. A. H. Allen, analyst for the Northern Division of Derbyshire, deposed to having analysed the flour, and finding it adulterated with alum in the proportion of twenty-four grains to four pounds of flour, or, roughly speaking, about a quarter of a pound of alum to a sack of flour. Alum was used, particularly in bad seasons, to improve inferior flour. Cross-examined by Mr. Barker: He found alum in the flour. There were two kinds of alum, one composed of sulphate of alumina and potash, and the other of sulphate of alumina and ammonia—hence the names potash and ammonia alum. He obtained alum in the form of crystals from the flour. The way in which he arrived at the result was as follows:—He shook the flour with chloroform, which was a heavy liquid. The flour floated, and the alum sank to the bottom. It was from what sank that he obtained crystals in the characteristic form of alum. He tasted it, and it had the astringent taste of alum. It gave the logwood reaction such as alum gives. He placed about thirty grains of flour in the chloroform, and the precipitate was probably about one-eighth of a grain. He let the chloroform evaporate and so obtained the crystals. Alum crystallized in octohedra of the cubical system. The alum was in a fragmentary form until water was added to the deposit from the chloroform, and the liquid filtered and evaporated. Silica crystallized in hexagonal prisms and could not be mistaken for alum. Besides, it was insoluble in water. He had made an analsyis for the purpose of estimating the quantity of alumina present, and he found it was in the proportion corresponding to thirty grains of alum to four pounds of flour. He made an allowance of six grains, equal to the amount of silica found in the sample. The allowance was made in accordance with the researches of Mr. J. Carter Bell, who had analysed upwards of 100 samples of flour. Mr. Carter Bell found the alumina natural to flour, if calculated to alum, was on an average equal in amount to the silica of the flour. He based his opinion upon the quantity of alumina present, after the deduction of six grains, which he believed to be naturally present. Alum was present, because he saw it under the microscope and tasted it in the deposit from the chloroform. Thirty grains was a very small quantity to work on, and he should not have used so little had not the quantity received from Colonel Shortt been very small. The alum in 30 grains was distinctly astringent in taste. The flour also imparted a blue colour to a solution of logwood. He was positive alum was present, but he would not say whether it was ammonia alum or potash alum. Re-examined by Mr. Binney: Clay and dirt might be present in the form of a silicate of alumina, but it would not be soluble in water, and would give no reaction with logwood. Further examined by Mr. Barker: It was not an unusual practice for millers to mend their stones with a preparation of alum. He was not aware that they washed them with a solution of it. Mr. Barker, in defence, said that he did not wish to say anything against Mr. Allen, but the question to be decided was whether the Bench were satisfied that Mr. Allen could not be mistaken. He believed that Mr. Allen had innocently—he would say innocently—drawn upon his imagination, when he said he had tasted the alum extracted from 30 grains. A simple calculation would shew that the alum present in 30 grains of the flour was about the three-hundredth of a grain. From the cross-examination which he thought it his duty to submit Mr. Allen to, it was perfectly clear that the question of calculating alum in flour was one which exercised the minds of analytical chemists all over the country. There were cases where chemists could at once come forward and state positively that alum did exist in the flour, but in the present case it was really a matter of opinion and nothing more, and Mr. Allen had given reasons why he had formed that opinion, which was so hostile to his client. He should call an analyst, Mr. Bell, brother to Mr. Carter Bell, and after that evidence they might come to the conclusion that although it might be a case of suspicion, that amount of proof was wanting which alone would justify them in convicting the defendant. There was nothing astonishing in finding alumina twenty-four grains of alum in wheat which was perfectly pure and unadulterated. This he believed was especially the case with wheats of foreign growth. He was instructed that the English wheats had been so bad for some time that the defendant had been obliged to make his flour from foreign grain. Thomas Ford, foreman at Mr. Widdowson's mill, spoke to Colonel Shortt purchasing the flour. No alum had been put into the flour, nor was there any about the place at the time. They had used alum sometimes. They used it for filling up the cracks in the millstones. The flour was made from foreign wheat. Mr. H. S. Bell, analytical chemist, Sheffield, said he received a packet of flour from Mr. Widdowson. He analysed it for the purpose of detecting alum. He first tried the logwood test, which gave a slight blue reaction, which alone was not absolutely conclusive of the presence of alum. No chemist would be perfectly satisfied with that test alone—it was not infallible. He then proceeded to analyse the flour in order to discover the quantity of alumina. He found it in the proportion of 17·2 grains of alum to three pounds of flour, which was nearly what Mr. Allen found it. That was a quantity of alumina which was sometimes found in pure and unadulterated flour. He thought it was practically impossible to find the other constituents of alum in flour. He found 8·5 grains of silica. It was consistent with known experiments to find 17·2 grains of alumina with 8·5 grains of silica in flour. With regard to the chloroform test applied by Mr. Allen, he thought that the three-hundredth part of a grain of alum would be deposited from thirty grains of flour. Having regard to the quantity of alum which would be precipitated from the thirty grains, he did not think it possible for Mr. Allen to come to any positive conclusion. He also thought it impossible to distinguish alum in such a small amount by the taste or by the microscope. He should be sorry to swear there was alum in the flour, though he was of opinion that the case was one of great suspicion. Cross-examined by Mr. Binney: He had had some experience in analysing bread for alum. He had analysed several samples. He had never tried the chloroform process. He had forgotten that it was published in THE ANALYST for January, 1879. He tried the logwood test, and he got a faint blue colour. Magnesia, or iron, or alumina in solution would give it. He, however, did not find either iron or magnesia present in the sample. He could not account for the blue colour with logwood unless there was alum present. He ignored the results of the chloroform test. Mr. Barker, acting on a suggestion from the Bench, asked that the third packet of flour which was in the possession of Colonel Shortt might be sent to Somerset House for analysis, as was provided in the Act in case of difficulty. His client courted investigation, and would pay the expenses if the decision was against him. Mr. Rodgers, the magistrate, said there was a difficulty in deciding between the two analysts, and it would be better to have another opinion as to whether alum was contained in the flour. Mr. Binney said he thought he *had given sufficient proof* in the case, and he had confidence in leaving the case in the hands of the

Bench. Mr. Rodgers said they were satisfied with the evidence up to a certain point but the question which remained was whether they should believe Mr. Allen or Mr. Bell. Mr. Allen said he saw and tasted the alum, and Mr. Bell said he did not believe it was possible to do so. Mr. Binney remarked that he had no objection to another analysis being made. After some further discussion it was agreed to forward the third sample to Somerset House for analysis, and the case was adjourned for a month.

NOTES OF THE MONTH.

Verily some people are hard to please! We have frequently been obliged to point out, in reply to the *Pharmaceutical Journal's* articles abusing analysts as alone responsible for prosecutions which turn out to be questionable in their propriety, that the analyst can only give the facts of the case, and has no power either to suggest or arrest prosecution. Judge then our astonishment when this distinguished weathercock suddenly turns round and blames an analyst for actually interfering to stop a questionable prosecution. It seems that Mr. Allen, of Sheffield, being present at a dinner of the Sheffield Druggists, and feeling somewhat hurt at the idea spread abroad amongst them by such articles as those referred to, as to the analyst being alone to blame for all prosecutions, made some remarks characterised by after dinner freedom, and showed how, when on one occasion he had attempted to point out that although his analysis of a drug exhibited a departure from exact purity, it was not in his opinion a case for prosecution, he had been told to mind his own business and leave such points to the local authority. Surely here was an analyst exercising the very wisdom which the *Pharmaceutical Journal* roundly charged some time ago as being wanting in Mr. Arthur Angell, but yet out comes an article taking our very words, and insisting that the analyst should never interfere, and blaming Mr. Allen for his speech. If Mr. Angell was wrong, surely Mr. Allen was right; and if both were wrong, will the *Pharmaceutical Journal* kindly show the remedy? If it cannot, we are clearly entitled to demand that in all cases of doubtful prosecutions depending not on results, but on their interpretation, no blame shall be by inference attached to the analyst after this admission of his powerlessness to interfere. It is no wonder that in a business where standards are so much wanted, that members even squabble over the very titles they can legally write over their shop doors, there should now and then occur doubtful points, and that the intellect of their great apostle should occasionally be so "obfuscated" as to induce self-contradiction such as that above alluded to.

According to the Hull magistrates, the addition of 25 per cent. of potato starch to compressed yeast is not an adulteration, but the bench evidently decided on their clerk's *dictum* without any scientific or practical evidence. Anyone who has had occasion to examine many samples of such yeast knows very well that it never ought to contain any notable proportion of starch, and if it was known to do so, no person in the trade would give a price for it. Indeed, it is a fact, that several of the larger consumers think it worth their while, every now and then, to send their yeast to a microscopic expert with the view of preventing their suffering from this very imposture, and find the cost well repays itself.

With reference to some communications as to the non-publication of certain papers which, although read before the Society, have not appeared in our pages, we may state that we are *in this respect* entirely under the orders of the Publication Committee of the Council, who alone have the right of arranging the order of publication of the Society's transactions, and who, if they see fit, may even altogether decline to permit us to print a particular paper.

Local authorities should remember that the Sale of Food and Drugs Act simply applies to the sale of an article not of the nature and substance required, and that articles bad from decomposition should be dealt with under the Public Health Act. This point should also be kept in view by analysts, and if they get a sample of an article which is genuine, but in their opinion decomposed, they should simply return it as genuine in their certificate, and request the inspector to call the attention of the medical officer to the article. Had Mr. Angell and his authority both remembered these points we should have heard nothing of the vinegar case containing microscopic organisms, which was rightly dismissed at Droxford when brought under the Sale of Food and Drugs Act, but with the sale of which the medical officer might have seen fit to interfere had he been notified of it.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
1481	W. Muller	Manufacture of Ammonia	6d.
1959	J. Hopkinson	Electric Lamps	4d.
1969	A. Longsdon	Electric Light Apparatus or Lamps	6d.
1971	A. M. Clark	Lighting by Electricity	8d.
2000	J. Conguet	Electric Lamps	2d.
2006	J. B. Spence	Treatment of Metallic Sulphides	4d.
2706	Ditto	Combining Metallic Sulphides with Sulphur	4d.
2060	A. F. Blandy	Apparatus for Electric Lighting	6d.
2101	W. P. Thompson	Manufacture of Aluminium Soduim, &c.	2d.
2110	C. W. Siemens	Producing Light and Heat by Electricity	10d.
2111	W. R. Lake	Electric Lighting Apparatus	6d.
2137	G. Bischof	Apparatus for Purification of Sewage, &c.	4d.
2290	Ditto	Preserving Butter	4d.
2199	I. Furstenhagen	Lighting by Electricity	2d.
2204	J. Pattinson	Manufacture of Soluble Phosphates	2d.
2267	G. Grout	Illuminating by Electricity	2d.
2293	L. McIntyre	Manufacture of Manure	6d.
2301	R. Werdermann	Apparatus for Electric Lighting	6d.
2322	C. D. Abel	Electric Lamps	2d.
2828	Ditto	Production of Sulpho-Acids of Rosaniline	2d.
2321	J. D. Andrews	Production of Electrity for Illumination	6d.
2339	A. M. Clark	Obtaining Light by Electricity	6d.
2340	Ditto	Electrodes for Electric Lights	2d.
2386	W. E. Hartmann	Manufacture of Sulphuretted Hydrogen Gas	6d.
2387	E. Solvay	Manufacture of Soda	8d.
2402	T. A. Edison	Electric Light	10d.
2414	S. G. Thomas	Phosphates	2d.
2502	F. E. Beanes	Glucose	2d.
2511	H. Lake	Manufacture of a Sulpho-Acid or its Salts	4d.
2539	L. Thiercelin	Extracting Iodine from Sea Weed	2d.
2543	F. J. De Hamel	Manufacture of Carbon Candles for Electric Lighting	4d.
2599	H. Chamberlain	Treating Sewage	2d.
2645	J. H. Valentine	Volatilizing Cresylic Acid	6d.
2745	G. W. Von Nawrocki	Production of Hydrofluosilicic Acid	2d.
2769	H. E. Newton	Electric Lighting	2d.
2860	S. Pitt	Production of Hydrocarbons	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; *Society of Arts Journal.*

THE ANALYST.

APRIL, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on Wednesday, the 17th instant, at Burlington House, Piccadilly, the President, Dr. Muter, in the chair.

The Scrutineers having examined the voting papers reported that the following gentlemen had been duly elected as Members:—

J. G. Tatters, Chemist to the Jarrow Chemical Works, South Shields.
F. P. Perkins, Public Analyst for Exeter.
Elwyn Waller, Ph.D., F.A.C.S., School of Mines, Columbia College, New York.
H. A. Mott, Ph.D., F.A.C.S., 117, Wall Street, New York.
H. Lancaster Hobbs, Analytical Chemist, Holborn Viaduct.

The following gentlemen were proposed for election as Members, and will be balloted for at the next Meeting:—

F. A. Bond, M.B., &c., Brincklow, Coventry.
J. Napier, Public Analyst for West Suffolk, &c.
H. S. Carpenter, Analytical Chemist, Holborn Viaduct.

The following papers were then read and discussed:—

"On a Peculiar Water," by Dr. W. Wallace.

"On the Estimation of Phosphoric Acid in Phosphatic Materials," by A. Smetham, F.C.S., and Mr. Dyer, Mr. Hehner, Dr. Bartlett and others took part in the discussion which ensued, and Mr. Smetham replied.

"On the Work Done during 1879 under the Sale of Food and Drugs Acts," by G. W. Wigner, F.C.S., when Dr. Dupré, Mr. Hehner, and others made some important remarks on the recently issued Report of the Inland Revenue Commissioners.

"The Effect of Light upon some Reagents and Chemical Compounds," by T. P. Blunt, F.C.S.

The President called attention to an abstract in the *Journal of the Chemical Society* of a paper by Mr. Allen "On the Analytical Examination of Tinctures," which had been read before the Society of Public Analysts and published in THE ANALYST last year. This paper had been reprinted by the *Pharmaceutical Journal* and of course acknowledged, but the abstractor of the Chemical Society described the paper as being from the *Pharmaceutical Journal*, thus ignoring both the Society of Public Analysts and THE ANALYST. The President thought the Committee of Publication of the Chemical Society's *Journal* should have their attention directed to the matter, as this was said to be not the first time such a thing had occurred.

The next Meeting of the Society will take place on April the 14th, at Burlington House.

ON THE WORK DONE DURING 1879 UNDER THE SALE OF FOOD AND DRUGS ACT.

Owing to several of the returns from Public Analysts having been sent in within the past few days, we regret to state that we are compelled to hold over this interesting tabular statement, together with the paper written on the subject until next month; but we may mention that it comprises returns from as many as 200 districts, which is a much larger number than we have been able to include in any previous statement. We are also obliged to postpone until our next number the observations made by members of the Society on the recently issued Inland Revenue Commissioners' Report.

ON THE DETERMINATION OF THE SPECIFIC GRAVITY OF BUTTER FAT AND OTHER SOLIDS AT ORDINARY TEMPERATURES.

By A. Wynter Blyth, M.R.C.S., F.C.S., &c.

Read before the Society of Public Analysts, on 18th February, 1880.

I consider it far more convenient to take the specific gravity of solid butter fat at 15° than at higher temperatures. My procedure, which has no claim to originality, is as follows:—A short wide test tube is taken, and a little mercury is placed at the bottom, or, which is perhaps more convenient, a lead weight is attached by means of a little wire cage. This is now suspended to the scale-hook by a fine thread of glass and weighed in water, the height of the water in the beaker being noted and kept constant in any subsequent operation.

The same tube is now filled with a weighed portion of the filtered butter fat under examination, and the whole weighed in water. From the data thus obtained the usual calculations are made.

Thus, as an example:—

	Grms.
Weighted test tube in water	18·224
Weight of butter fat in air	22·223
Loss of weight in water	1·722

then

$$\frac{22{\cdot}223}{1{\cdot}722 \times 22{\cdot}223} = 9280 \text{ sp. gr.}$$

I find that the average specific gravity of Devon butters taken in this way is ·9275, whilst butterine is ·8467. This method is also excellent for the purpose of determining the specific gravity of a variety of organic solids, whether they be lighter or heavier than water.

If, for example, it is necessary for the purpose of the pathologist to take the specific gravity of kidney or muscle, the tube with mercury is weighed as before, a section of the tissue cut by means of a cork-cutter so that it exactly fits, and, indeed moves rather tightly into the tube, and the surface of the section covered with the mercury and then weighed in water. Should a solid be full of pores, as—for example—bread, it may be placed in a tube, stoppered with a caoutchouc doubly perforated cork, one perforation carrying a thistle head funnel tube, the other a tube for connection with a *sprengel.* In the throat of the funnel a solid rod is ground airtight, and the mercury is poured into the funnel. On now completely exhausting the tube of air, the solid stopper is gently loosened and a thin stream of mercury allowed to pour in; thus the solid is completely injected and all errors from air avoided.

ON BLOWPIPE ASSAYS OF SILVER LEAD.

By F. Maxwell Lyte, F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

In making blowpipe assays of lead ore, one considerable disadvantage and cause of inaccuracy has always been the extreme minuteness of the button of silver usually obtainable. By the following simple method the whole of the silver may be collected from a comparatively large quantity of ore, so as to be able to obtain a really ponderable button, even before the blowpipe. From one to five grammes of the lead ore to be examined are reduced to fine powder, and treated with strong HCl., and boiled till the whole of the lead has become converted into $Pb.Cl_2$. This usually takes place rapidly. The solution, together with the gangue, is evaporated to dryness on a water-bath, and for each gramme of lead ore which has been employed 50 or 60 c.c. of saturated solution of chloride of sodium is to be added. This being heated to boiling, with the residue of the evaporation of the acid solution of the ore takes up all the $Pb.Cl_2$ and the Ag.Cl. The solution is filtered, as hot as possible, into a beaker, or capsule, and the precipitate washed on the filter with a little boiling brine, the washings being added to the rest of the filtrate. Meanwhile a little spongy lead is prepared by reducing a solution of lead acetate with a rod of metallic zinc, and four or five bits of this spongy lead, about the size of peas, are to be added to the hot brine solution and digested with it on a water-bath for a few hours. Such bits of spongy lead will not really weigh altogether more than ·04 to ·05 grammes, and these will collect all the silver from the solution. The spongy lead should not be compressed when put into the brine, and will float in it, and while they are digested together they should be frequently stirred and agitated with a glass rod. The lead, as soon as placed in the brine, will be seen to change from its blue grey tint to a dull silver grey, and this reaction also affords a delicate test to see when the extraction of the silver is complete. It is only necessary to drop into the solution a fresh morsel of spongy lead, and observe whether it changes colour or not. As soon as the reaction is complete, and all the silver has been withdrawn from solution the argentiferous lead may be collected and fused with Na_2CO_3 on a charcoal support, and finally cupelled; and if properly manipulated, a lead button may be obtained containing all the silver from several grammes of ore, and yet able to be cupelled before the blowpipe. With a little practice the operator will soon find out how to apportion the quantity of spongy lead he employs to the quantity of ore worked on, so as to obtain a button of treatable size, and yet containing ponderable quantities of silver.

ON THE PERSISTENT OCCURRENCE OF STARCH.

By Frank P. Perkins, Public Analyst for Exeter.

Read before the Society of Public Analysts, on 18th February, 1880.

Things trivial in themselves occasionally assume a high degree of importance, and in the daily whirl we are too apt to overlook it. There is a substance used extensively by everyone, everywhere, constituting a great portion of our daily food, and yet its very commonness makes us forget how widespread it is. This substance is starch. Until it is brought home to us in some direct manner we do not bestow a thought on the fact that it is always present with us, and that the dust of our houses, and the air we breathe must contain starch. My attention was first called to what may be named the "Persistent Occurrence of Starch," in rather a notable way. Not many months since I was engaged on a case in which a woman was charged with the murder and mutilation of a child, a case horrible in all its details, the end of which was that the murderess paid the full penalty of her crime on the scaffold. Many articles were submitted to me for examination; among them a chopper, on which was a stain that proved to be not blood, but starch discoloured by iron rust. Another thing was a razor, on which was found blood and *starch*. I spent some time in endeavouring to solve the problem, How did it come there? Supposing the child had been fed with farinaceous food, and this instrument used in severing the head from the body, would any starch have been likely to adhere to it, and was there any connection between the razor and the chopper? A piece of floorcloth turned up. It had been taken from the mill-stream, and was said to have been the piece in which the child's head was wrapped when it was thrown into the water. It was thoroughly soaked with water and rotten; it had evidently been in the water for a long while, water insects had taken up their abode on it, and were clinging to it. It was minutely examined, but—as might be expected—no blood stains were discovered, but starch again made its appearance—not a few grains here and there, but every part was crowded with granules. It was thickly coated in some places with a black incrustation; this appeared to be nearly made up of starch. I began to open my eyes. This starch had evidently not come from the body. Could the floorcloth have formerly been placed beneath some table on which culinary operations were performed. Full of these thoughts I went to my own kitchen, and transferring a little of the inevitable dust from the matting placed under the table to a glass slide, I submitted it to microscopical inspection; there were the granules of starch plain enough. I was now fully awake. I went to the lobby, and in the dust of the floor starch was present; I went to the stairs, starch was again found. Evidently then, the occurrence of starch in this investigation was but of little value, although that in the child's food bottle afterwards examined was found to be similar in character, and although the woman stated in her confession that the chopper had been used in the way at first suggested, after which she washed it. But what these observations lead to is this, viz: the way in which starch granules are carried or wafted everywhere. I have since examined dust from the floor, and the ledges of the door of my laboratory; freshly deposited dust from a sideboard; dust from high up on papered walls; dust that had settled on new woodwork in a room, dust from the mouldings of the street door, and in every instance starch granules have been identified. The granules have in all cases been confirmed by means of the polariscope, much in the same way as suggested by Dr. Tripe, in his interesting paper in the December number of The Analyst;* and probably starch may be frequently overlooked or species confounded without the aid of this beautiful and useful apparatus. I have thought it worth while to bring these thoughts before you, because I believe the consideration may be applied, and be helpful in discriminating between wilful and accidental adulteration of certain articles of food.

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* Vol. iv., p. 221.

ON A PECULIAR WATER.

By Dr. Wallace.

Read before the Society of Public Analysts, on 17th March, 1880.

The following analysis of a peculiar water may be interesting to some of the members of the Society of Public Analysts. It was obtained from a very deep bore, the strata penetrated consisting entirely of sedimentary rocks of the lower coal formation, but volcanic rocks are found at no great distance. The distinguishing feature of the composition of the water is the occurrence of a barium compound, the entire absence of sulphates, and the presence of a large quantity of chlorides. An immediate precipitate is obtained by adding the solution of a sulphate (even calcic sulphate) to the water. The free ammonia is somewhat large, and the amount of oxygen required to oxydize the organic matter is considerable. A second sample taken after the interval of a month, during which a large quantity of water had been taken from the bore, still gave an immediate precipitate, with solution of sulphate of lime, and contained almost exactly the same quantity of chlorine.

	Parts per million.
Barium Carbonate	54·1
Calcium ,,	262·6
Magnesium ,,	23·0
Calcium Chloride	92·4
Magnesium ,,	78·0
Potassium ,,	24·0
Sodium ,,	1783·0
Alumina, &c...	8·0
Silica	7·0
Organic and Volatile	85·0
Total Solids....	2417·1
Hardness, degrees per million	537
Oxygen required to oxydise organic matter	1·67
Ammonia, free, per million	·95
Do. organic	·07

THE EFFECT OF LIGHT UPON SOME REAGENTS AND CHEMICAL COMPOUNDS.

By T. P. Blunt, M.A. Oxon., F.C.S.

Read before the Society of Public Analysts, on 17th March, 1880.

The following remarks are for the most part of a practical character, and intended to point out the importance to the chemist of a consideration of the effects of exposure to light upon some of the ordinary reagents of the laboratory, which have not been usually regarded as subject to its influence. My attention was first drawn in this direction in the course of an investigation into the action of light on certain organisms, upon which Dr. A. H. Downes and I have been engaged for more than two years. Nearly all our results have been embodied in a series of papers read before the Royal Society, but it may not be considered impertinent to reproduce here such of them as have a bearing upon the practical question of the preservation of reagents. I do not pretend that all the facts detailed below are new, but some of them have certainly not received the attention they deserve. Oxalic acid forms a most useful basis for a standard solution, owing to the ease with which it is obtained in a pure state by crystallization, and subsequently weighed, but it has fallen into disrepute on account of the instability of the normal solutions prepared with it; now it has been clearly proved by us that this instability is solely due to the action of light, and that normal volumetric oxalic solution (6·3 per cent.) may be preserved unchanged for any period in the dark. The same remark applies even to the decinormal (0·63 per cent.) solution, if the precaution be taken of first boiling to destroy germs or organisms, otherwise it may become turbid and lose strength in the dark. In the light decinormal oxalic solution is rapidly destroyed by oxidation. In one of our experiments, made in test tubes, partially filled, and plugged with cotton wool, six months' insolation, between Jan. 21st and June 15th, sufficed to destroy both acid taste and reaction, apparently leaving nothing behind but pure water—the carbonic acid formed having of course escaped. I have already, in the columns of THE ANALYST, called attention to the fact that a weak permanganate solution, such as that used by Tidy in water analysis, is perfectly permanent for one month when kept in the dark. My experience extends now over a longer period, and I find that such a solution may be preserved unchanged in the dark for many months, in spite of variations of temperature. Potassium iodide and ferrous iodide are a pair of compounds whose conduct under light is mutually anomalous; solid potassium iodide in presence of light and moisture soon becomes tinged with yellow through the liberation of iodine, while it is a fact well known to pharmacists that in order to preserve the syrup of iodide of iron (ferrous iodide) from discolouration it should be placed in white glass bottles in the strongest available light. We once half filled a test tube with the syrup and exposed it in a window, in the summer. Each morning a brown layer appeared on its surface, the accumulation of the past night. This gradually disappeared in the sunlight, so that before evening the contents of the tube had once more become completely colourless, and this phenomenon occurred as long as the experiment was under observation. It was satisfactorily proved that the only effect of the sugar was to render the solution more stable, for aqueous solutions of ferrous iodode were found to become discoloured much more rapidly in the dark than when exposed to sunlight. Solutions of potassium iodide behave in an exactly opposite manner to those of ferrous iodide in all the respects mentioned above; they become discoloured under sunlight, but can be preserved indefinitely in the dark, and if a dilute solution which has turned yellow in the light be afterwards screened from it, the colour very gradually disappears.

The cause of the discolouration of potassium iodide by light having been much discussed of late years, it may perhaps be worth while to give a somewhat detailed account of our own attempts at the solution of the problem. Four tubes containing a weak solution of the salt, which filled them to about one-third of their capacity, were exhausted at the sprengel pump; air which had been freed from carbonic and all other acids by long contact and frequent agitation with caustic potash was then admitted by a special arrangement, and the tubes were sealed off; two were insolated and two encased. At the same time some more of the solution was placed in four ordinary test tubes, which were simply plugged with cotton wool, and exposed to sunlight and darkened respectively in a similar manner to the previous pairs. All the insolated tubes rapidly became coloured, no difference being noticeable between the rates of colouration in the tubes containing ordinary and purified air, those kept in the dark being perfectly preserved. A pair of tubes was now charged with solution, exhausted and sealed off. No change took place on insolation, and thus the somewhat improbable alternative of mere dissociation was disposed of, and the conclusion remained that the effect of light was due to direct oxidation, without the intervention of any acid.

There can be little doubt that solution of potassium iodide of any strength could be perfectly preserved in a well-stoppered bottle in the dark, and would be much more convenient than the fragments of solid salt we are most of us in the habit of using. A similar reaction to that observed in the case of potassium iodide under light occurrs with dilute solutions of all the alkaline oxalates, which are gradually oxidized, with the formation of carbonates, but much less rapidly than a solution of oxalic acid of corresponding strength. In operating on solutions containing the same proportion of acid radical it was found that the decomposition was nearly equal in the case of the oxalates of sodium, potassium, and lithium, but somewhat greater in that of the ammonium salt; hence it would appear to be desirable to keep solutions of ammonium oxalate in the dark when they are required to be preserved of uniform strength—as for instance, where they are employed in the volumetric estimation of lime.

In the course of one of our experiments two tubes were partially filled over mercury with a mixture of atmospheric air and ammoniacal gas, one was then exposed to light and the other darkened. On examining the tubes after many months the mercury had risen in the encased tube. The surface of the metal was blackened and its convexity lost, these appearances being evidently due to oxidation. In the tube in the light, on the other hand, the level of the mercury remained unchanged, and its surface was clean, bright and convex.

These results afford strong presumptive evidence against the formation of ozone in sunlight, and consequently against the views of those writers who have ascribed some of the phenomena of oxidation under light to its intervention, for it is well known that a trace of ozone in air is capable of destroying the convexity and lustre of the mercurial surface.

Dr. Dupré said he heard a similar paper read some time ago, and he went the next day and examined his decinormal oxalic acid which had been made about 14 months, and standing in a place never struck by sunlight. He had some of the exact acid with which it was made and could certainly find no difference between the two.

Dr. Muter said that had it been in the light it might have been affected. He thought it was probably through germs if any change took place. If no germs could get in it a solution might remain correct for a number of years.

Mr. Hehner pointed out that some germs were not fond of light as they flourished much better in the dark. If fungus were exposed to the sunlight it would very quickly die.

Dr. Bartlett said that he had some potassium iodide which had been for about 20 years in the dark in his laboratory, and it had become of a deep yellow colour.

ON THE PRESENCE OF ARSENIC IN THE ATMOSPHERE.

By H. C. Bartlett, Ph.D., &c.

Having been very anxious to ascertain if arsenic in any form can be detected in the atmosphere of a room papered with arsenical wall paper, I have made a series of preliminary experiments which appear to prove that this highly important object can be satisfactorily accomplished.

I. I first took a large glass jar, in which I placed three square yards of wall paper, known to be free from arsenic and antimony. I then passed a gentle stream of pure hydrogen, obtained from the gradual decomposition of sodium amalgam, through the jar, directing the jet of gas upon a filter paper moistened with very slightly acid silver nitrate. When this experiment was conducted in complete darkness, or with the assistance of completely non-actinic light, no reaction took place during an exposure of twelve hours.

II. Repeated this experiment, after passing a small quantity of ammoniacal gas through the jar, with the same result as before.

III. This time I varied the experiment by producing the hydrogen by the decomposition of zinc in dilute sulphuric acid. After twelve hours a slight stain on the filter paper induced me to continue, greatly increasing the quantity of hydrogen passing through the jar. A deep brown mark then resulted. This was very unsatisfactory, as both the zinc and the acid appeared to be free from arsenic and antimony when tested by Marsh's process.

IV. My next attempt was to substitute aluminium and pure potassic hydrate for the acid, and afterwards magnesium for the zinc, and when no actinic light fell upon the nitrate of silver paper no discolouration took place. I therefore assume that my samples of zinc, or sulphuric acid, contained a trace of arsenic too minute to be detected by Marsh's test, but sufficient to give a strong reaction with ammoniacal silver nitrate.

V. Taking the same quantity of wall paper as in the previous experiments, but selecting one coloured with a large quantity of arsenical pigment, I moistened the back of the paper slightly, and then passed a little ammoniacal gas through the jar. The hydrogen from sodium amalgam being the purest and most easily available, I chose this, and I am happy to say that in each of the three experiments so carried out there has been a characteristic reaction, proving to my mind conclusively that arsenic in a gaseous or pulverulent form, emanating from wall paper, can be detected.

I am now about to try a long continuous experiment of passing pure hydrogen with a trace of ammonia over the surface of 20 square yards of paper in the hope of being able to collect the resulting arsenious compounds of silver salt (arsenite of silver).

MILK OF RUMINANTS.—In all probability there has not been sufficient attention, thinks Dr. Brush, drawn to the differences existing between the milk of animals who ruminate, as the cow, and those who do not chew the cud, as the ass and the horse; and he would divide milk into two classes—that which is the product of cud-chewing, and that which is the product of non-cud-chewing animals. The milk of the cud-chewers contains a variety of caseine, which, under the action of the digestive process, coagulates into a hard mass. Contrary to the often-expressed belief, he declares that this coagulation takes place in the ordinary process of digestion in the calf. He had one tied up, out of the reach of any food, and had it fed with freshly-drawn cow's milk. Half an hour after its meal, he always found it busily chewing the cud. After many inquiries, he has ascertained that the same takes place with the sheep and the goat; and from these facts, he is inclined to explain the difficulty often experienced by the human stomach in properly digesting the milk of ruminating animals. The other variety of milk, to which human, equine, and asses' milk belong, does not under the action of acids in the same way coagulate into the hard mass that is found in cows' milk, but coagulates rather into small granular or flocculent masses, which are easily diffusible. This would explain why Kumyss prepared from cows' milk is found to agree better with children than cows' milk itself; the Kumyss has been, so to speak, already chewed. In the milk of the cud-chewers there is but a small amount of sugar and a large amount of caseine, while exactly the reverse of this is the case with the milk of the non-cud-chewers; and in this fact there is again a reason why the milk of the latter, at least in the case of children who cannot get their natural supply, is to be preferred. It will be remembered that Kumyss is a beverage prepared by the people of Yakutz from mares' milk, and found to be highly nutritious, but that the beverage referred to by Dr. Brush is a product artificially prepared from cows' milk.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

TO THE EDITOR OF "THE ANALYST."

SIR,—With regard to the vinegar case at Droxford, reported in the last number of your journal, may I say a word?

I do not desire passionately to defend the action taken, but your editorial remarks have raised a curious point—one I think worthy of ventilation in your columns; namely, What is to be understood by the phrase "*nature, substance and quality?*" Does, or does not an article which has undergone decomposition meet the spirit, or even the letter of the demand?

I have never said that the acetic acid of the sample in question was decomposed. I found 0·22 per cent. less $C_2H_4O_2$ than Professors Voelcker and Graham. My portion was weighed, and perhaps theirs was measured.

In evidence it was shown that the pint served to the inspector was the dregs obtained by the tilting on end of a large cask, and doubtless most of the dirt, *matter out of place, and therefore foreign matter*, fell to the bottom of the collecting vessel, and thence into one of the three portions. I believe that I happened to have that portion, for my sample was so filthy as to be almost gelatinous—certainly mucous—in its consistency; the "eels" formed a translucent mass, plainly visible across my writing table, and to my mind it was totally unfit for food, and it needs a stretch of imagination and a miscarriage of our mother tongue to consider such dirty dregs, notwithstanding the percentage of acetic acid, as an article of the *nature, substance and quality* demanded, and worth the money spent upon it.

Undoubtedly it should have been thrown away, and not sold for good honest English coin.

The learned professors gave it in evidence that vinegar eels are not injurious. How do they know that? I don't venture to say they are, but they should be looked upon with suspicion as members of the order *Nematoidea*, some of which "infest abundantly the human body,"* and most of which are exceedingly tenacious of life, and will survive after almost complete dessication. He is a bold man who will venture to tell us which of the low forms of life are injurious to health, and which are not, and will dare to declare that the most innocent organisms may not sometimes set up foreign fermentation in the human body. These are matters as yet absolutely in the dark, and certainly much too remote and ill defined to be lightly sworn to in courts of justice as known conditions.

Can an article be at once genuine and "decomposed?" Are the following articles of the nature, substance, and quality demanded?

Drugs which have lost their essential properties by evaporation, precipitation, fermentation, and other so-called spontaneous changes; milk containing colostrum; whiskey which has been reduced by evaporation to 30° u.p.; trichinized pork sausages; a pepper whose percentage of acrid resin is not materially affected, but which is dirty and contains an excess of ash. These are a few of the questions which are opened up by a consideration of the late vinegar and other cases, and which may be summed up in one: Where does the Public Analyst's duty leave off, and the Medical Officer's commence? Is there a distinct line of demarcation between them, or do they not fuse at the margins?

The question whether or not a dirty sample of food, drink, or drugs is adulterated in the meaning of the Act, is to my mind dependent upon how much dirt there is present, and I am still of opinion that the vinegar in question was most certainly not of the nature, substance, and quality of the article demanded. And seeing that both of the learned professors in cross-examination admitted that they should not like such stuff upon their tables, and that the magistrates retired for something like twenty minutes before they could arrive at a decision, and that they would not grant costs, and that the defendant was warned not to sell such rubbish again, I maintain that the prosecution was neither frivolous, careless, nor improper.

Yours faithfully,

ARTHUR ANGELL.

REVIEWS.

Annals of Chemical Medicine.

By J. L. W. THUDICHUM, M.D. London: Longmans, Green & Co.

THIS first volume of a new periodical possesses very marked originality. Of chemistry, pure and simple, it contains but little; but of that chemistry which forms the boundary line between that science and physiology, it is full.

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* *Cobbold's Entozoa*, Chap. IV., page 53.

To take the most unfavourable feature first, some parts of the volume are of a very personal character. Dr. Thudichum feels himself aggrieved by unauthorised and unacknowledged use of his work. We can hardly wonder even if we regret that he takes the first really suitable opportunity to publish his grievances. He is by no means alone in this respect, fer every chemical reader knows how frequently personal matters are forced on his attention, because in no other way can the rightful claims of a discoverer or inventor be brought to notice.

Entirely apart from this we have a large amount of interesting biographical information, put before the reader with a peculiar and marked style, and with little facts, of much interest which would escape the notice of an ordinary writer. This is specially noticeable in some curious anecdotes of Meyer's life, which we do not remember to have seen anywhere else.

Infection and contagion are carefully and completely treated, *i.e.*, as completely as the space allows, and in this case certainly the author summarises the views of others so justly that he cannot be considered to give undue predominance to his own.

The chapters on the Organic Acids of the Brain, and on the Chemical Decomposition of the Bile will both be read with interest.

Blowpipe Analysis.

By J. Landauer. Translated by J. Taylor and W. E. Kay, 1879.
London : Macmillan & Co.

Until recently chemical literature has been very deficient in works upon this subject; and generally the only information the student could obtain on blowpipe analysis was from the few experiments given—in tables on qualitative analysis—for " the preliminary examination." We are sure this book will be favourably received: not only does it give most of the latest foreign improvements, but also those that have been added by England to this important method of analysis. In the first chapter is contained a very good account of the "apparatus and reagents" required, followed by one on the " Operations of Blowpipe Analysis," giving the reactions on the " Aluminium Plate "—Ross's—" Bunsen's Flame Reactions," &c. Chapters three and four are devoted to the reactions of the elements in combination, and the systematic examination for them. At the end of the work are a series of tables arranged as simply as it is possible: it is obvious that they cannot be so easily and systematically drawn up as tables for the examination of substances by the wet method. As usual, this work is prefaced by a coloured diagram of the spectra of the elements. We begin to doubt the possibility of the publication of any work on chemistry without this pretty coloured preface.

LAW REPORTS.

How Alum is Mixed with Flour :—

On February 21st, at the Retford County Police Court, Charles Loweth, miller, of Haughton Mills, was charged with having in his possession a quantity of alum, to be used for the adulteration of flour or meal. This case excited a great amount of interest, many millers and farmers being present. Mr. A. Lane, inspector, prosecuted, and Mr. Bescoby defended. Mr. Lane stated that from information he received he obtained a search warrant, and went to Haughton. Defendant and he went to the top of the stairs into an attic, where he found a bag full of alum (produced). He asked " What's this, Mr. Loweth ? " and defendant replied " It's alum, which I use for the accommodation of my customers." He searched about in the other rooms but found nothing more. Defendant told him he used the alum for filling up the crevices in the stones. He had since weighed the alum and found there were 5st. 4lbs. Albert Rinch (who had just preferred a charge against his master, and obtained an order for the cancelling of his indentures) said he had been an apprentice to Loweth. He had seen and used the alum by order of his master (the defendant) and the miller (foreman). He had put some into the stones to fill up the holes. He had also put it into the flour to strengthen it. By his master's orders he had put two or three handfuls at a time into a sack of flour. By Mr. Bescoby: He had not mentioned about it to a soul. He did not give information. Joseph Johnson (a miller, who had been discharged by Loweth the week before) said by Loweth's orders he had put three handfuls of the alum into every sack of flour. During the grinding process he put in a handful when the bags were "a stone high." That would have the effect of mixing it with the flour. By Mr. Bescoby: He knew it was wrong. He had never done it in the service of any other miller, but had seen it done. He had been four months with Mr. Loweth, who discharged him in a hurry last Saturday. Mr. Bescoby: Then you gave the information? Witness: Well, don't be too sure. I did not give the information. Mr. Bescoby then addressed the Bench for the defence, dwelling on the fact that alum, properly used, was an improvement, especially in such seasons as the last. He asked for the leniency of the Bench. This would be a serious thing for Mr. Loweth, and there were samples of flour before the County Analyst. This was not an offence committed only by Mr Loweth. Many millers were fond of using alum to strengthen unsound flour. Mr. Huntsman: But the object is also to make of bad flour what is called good flour. The Clerk remarked the lowest fine was 40s. and the highest £10. The Bench ordered the defendant to pay the full penalty of £10, including costs.

Purchaser must inform Vendor that Sample is to be Analysed by Public Analyst:—

Recently, at the Jarrow Police Court, Andrew Scott, White Mare Pool, was charged with selling adulterated milk in Jarrow. Mr. Bush, of Newcastle, defended. The certificate of the County Analyst, Mr. Edger, was put in, which showed 14 per cent. of added water. After the witnesses had been heard, Mr. Bush showed that the inspector (Mr. Edward Baty) had omitted his duty. He had told the parties that he was going to have the sample analysed, but, according to the Act, he should have told them that he was going to send it to a "Public Analyst." The Bench dismissed the case on the point raised. Defendant had been fined several times before for selling adulterated milk.

Milk Adulteration.—Severe Fines:—

Mrs. B. Sheldrich, No. 114, Henry Street, St. John's Wood, was summoned by the Vestry of Marylebone, for selling milk that was found on analysis to be adulterated with 36 per cent. of added water. Chapman & Co., of 108, High Street, Edward Blewin, of 54, Henry Street, William Jenkins, of 68, Bevington Road, George Nash and Jane Sangleir, of 4, Paradise Street, and John Sinfield, of 37, Hereford Street, appeared to answer like complaints. Mr. W. E. Greenwell, solicitor to the Marylebone Vestry, prosecuted; and all the defendants said they sold the milk as they had bought it. Mr. De Rutzen said he was sorry there appeared to be such a prevalence of adulteration. The excuse set up that the people sold the milk as they bought it was no excuse at all. If they did not like to avail themselves of the protection given them by the Act of Parliament they rendered themselves liable. They could buy the milk with a warranty, and if they took the trouble to do that it would soon put a stop to adulteration. But no one cared to do it, and they were thus liable for selling adulterated articles. In these cases the degree of adulteration varied from 38 to 14 per cent.; but to him the figures made little difference. The thing to be stopped was the fraud, and the fraud was the same in all the cases. He would make no difference in the cases at all, nor between the large and small dealers. There would be a fine of £5, and 4s. costs in each case.

Alum in Bread.—Public Analyst's Certificate confirmed by Somerset House Chemists:—

At the Eckington Petty Sessions, the adjourned hearing of the case reported in our last number was resumed. Mr. Binney, instructed by Col. Shortt, prosecuted. He said their Worships would recollect that in that case, at Mr. Barker's request, the third portion of the sample obtained by Colonel Shortt at the defendant's mill, was referred to the analysts at Somerset House for their analysis, and the following certificate had been received with reference to it:—"The sample of flour marked D 91, referred to in the annexed letter, was duly received on the 18th ult., and was securely sealed. We hereby certify that we have analysed the same, and declare it to contain not less than 18 grains of alum per 4lbs. of flour. As witness our hands this 5th day of March, 1880, J. Bell, R. Bannister, H. J. Helm." Mr. Binney (continuing) said it would be seen from the certificate that the analysis made at Somerset House fully bore out Mr. Allen's results, so it was a case in which their Worships would have no difficulty in making a conviction. He (Mr. Binney) was sorry, however, to say that he had received an intimation from the solicitor for the defendant that the defendant had died a week ago, consequently the case could not be proceeded with. The Bench said they had fully determined on the last occasion to convict, but as the defendant had died the case was terminated.

Mr. Binney said that informations had been laid against four other persons for selling adulterated flour and bread, and in each of the cases the flour had been purchased from Mr. Widdowson, and made into bread in the same state as it had been received from the mill. He pointed out, however, that the simple fact of their having purchased flour from Mr. Widdowson was not sufficient evidence to entitle them to an acquittal, because the Act of Parliament required, in addition to the proof, that a written warranty as to the purity of the flour should be given at the same time.

The first case was that of James and W. G. Pearson, grocers, Eckington. On the 29th November last Colonel Shortt, the inspector under the Adulteration Act, visited the defendants' premises, and purchased a loaf of bread. It was divided into three parts, one of which was submitted to Mr. A. H. Allen, of Sheffield, for analysis. Mr. Allen's certificate as to the result of the analysis showed that the sample was adulterated with alum in the proportion of 36 grains to 4 lbs. of bread. The defendants said that they had the assurance of Mr. Widdowson that the flour was pure, but they had not a written warranty. Oliver Ashmore, confectioner, Eckington, was the next defendant. A loaf of bread had been purchased by Colonel Shortt at the defendant's shop, and on a third part being analysed by Mr. A. H. Allen it was found to be adulterated with alum to the extent of 50 grains to 4 lbs. Defendant produced an Eckington newspaper, which contained an advertisement to the effect that the flour from which the bread was made was warranted perfectly pure. The flour was purchased from Mr. Widdowson. George Marsden, shopkeeper, Eckington, was summoned for a similar offence. A loaf of bread which was purchased at the defendant's shop was found, on a portion being analysed by Mr. A. H. Allen, to be adulterated with alum in the proportion of 28 grains to 4 lbs. Defendant said he was under the impression that the flour was pure. Joseph Dolby, grocer, Eckington, was charged with selling flour not of the nature and quality demanded. A sample had been purchased by Colonel Shortt, and on its being subjected to analysis by Mr. Allen was found to contain alum in the proportion of 70 grains to 4 lbs of flour. Defendant said he had used the flour just as he had received it from Mr. Widdowson's mill. He was not aware that it contained alum, but on the contrary believed it to be perfectly pure. The Bench said they had power to inflict a penalty of £20, but they did not wish to deal hardly with the defendants. It was nevertheless a serious offence for respectable men to be connected with cases of that description. The magistrates did not wish to look at the cases in any vindictive way, and under the circumstances they should only impose a fine of 5s. each and the costs, as they believed that the defendants had only made a mistake in buying the flour without obtaining a written warranty as to its purity, as required by the Act of Parliament.

Adulterated Butter.—A Servant's Mistake :—

At the Bishop Auckland Police Court, John Armstrong, of the firm of Armstrong & Co., pleaded guilty to a charge preferred under the above Act by Supt. Banks. It appeared that Mr. Banks went to defendant's shop and asked for a pound of butter. He was supplied with a pound, for which he paid a shilling. He submitted it to the County Analyst, Mr. Edger, from whose certificate it appeared there was no butter in it, but it was simply fat other than butter. Mr. Armstrong said that the article sold was butterine and that he had bought it as such. He was not at home and an apprentice had broken into a cask of butterine and thought it was butter, as it was the first they had had in, or it would not have been sold as such. The Bench were of opinion that it had been purely a mistake and not done to defraud, the lad having charged the same price as the butter. As the costs were £1 9s. 6d. the Bench made the fine as low as possible, 6d. and costs.

Sample not to be divided by purchaser unless desired by vendor :—

At Portsmouth, Charles Arthur, grocer, of Commercial Road, was summoned for having sold as coffee an article not of the nature, substance, and quality demanded by the purchaser. Inspector Redward said he went to the defendant's shop on November 28th, and asked what the price of coffee was. He was told that it was 1s. 4d., 1s. 6d., and 1s. 8d. per lb., and he asked for half a pound of that at 1s. 4d. He was served, and on the parcel was a label to the effect that it was a mixture of chicory and coffee. The inspector told the defendant that he had asked for coffee, and said he should divide the sample into three parts, giving one to the defendant, keeping one himself, and forwarding the other to the Borough Analyst. The Clerk asked the inspector whether he said he should divide the sample, or whether he gave the vendor the option of having it divided, and he replied, that having been served with the article he told the defendant that he should divide it. The Clerk observed that the case therefore fell through. The Act said that the purchaser should give the vendor the opportunity of having the sample divided, and if he did not desire this, then the whole had to be forwarded to the analyst, who would himself divide it. The Act of Parliament in question was very stringent, and in one case where the purchaser said he should send the sample to the analyst, instead of saying the Borough Analyst, the case was dismissed. The magistrates also dismissed this case on account of the technicality in question.

Adulterated Coffee.—Another Mistake :—

At the Southwark Police Court, Thomas Smith, grocer, 110, Russell-street, Bermondsey, was summoned for selling as pure coffee a mixture of 30 per cent. coffee and 70 per cent. chicory. Mr. Thomas said he caused to be purchased half a pound of coffee at the defendant's shop. On the same day he sent a portion of it to Dr. Muter, and his certificate showed that it contained 70 per cent. of chicory. Defendant said it was a mistake, as he was out of printed wrappers at the time, and should have written on the paper "Mixture of coffee and chicory." Mr. Slade fined him 40s. and 12s. 6d. costs.—Misses Milde and Sanger, 10, Snow's Fields, were also charged with selling coffee mixed with 50 per cent. of chicory, and butter containing 77 per cent. of added fat. Mr. Thomas said that the defendants were females in a small way of business. He, however, had cautioned them before. Mr. Slade, after hearing the evidence, fined them 40s. and 12s. 6d. costs.

Adulterated Coffee.—Notice of Mixture after Sale :—

At the Southampton Police Court, Charles Baker, grocer, 8, Upper East Street, was summoned for having sold coffee, adulterated 50 per cent. with chicory, to the prejudice of G. H. Collis, inspector, for whom the Town Clerk (Mr. R. S. Pearce) appeared. Mr. Bell appeared for the defendant. A lad named William Harvey stated that, acting under the directions of Mr. Collis, he went to the defendant's shop and purchased a pound of sugar at 4d. and a quarter of a pound of coffee at 1s. 4d. per pound from the assistant in the shop. He paid for the goods and got change, and asked the assistant, "What did you sell this for?" The assistant said "chicory and coffee." Mr. Baker then remarked to Mr. Collis, "Pure coffee is 1s. 6d." The coffee was weighed up in witness's presence. Cross-examined: He knew if there was anything wrong with the goods he purchased that it would be a case before the magistrates, but he did not read what was on the paper covering the coffee. The coffee was placed in paper folded in the shape of a funnel. Mr. Baker came in the shop after Mr. Collis had placed the coffee he had received on the counter, and, placing his hand on it, said, "This is a mixture of chicory and coffee." Witness did not hear Mr. Collis say, "It is too late." When he first went into the shop he asked for half a pound of coffee and one pound of sugar, and had not enough money to pay for it. He afterwards asked for a quarter of a pound of coffee for 4d. In reply to the Bench, witness could not say if the half-pound of pure coffee was in the same sort of paper as the coffee he afterwards received, nor could he say if both coffees were taken from the same canister. Mr. Bell said it was obvious if the boy had asked in the first place for 1s. 4d. coffee he had put down money enough. Mr. Collis deposed to sending the last witness into the defendant's shop for some sugar and coffee, and to the latter being in a square and not funnel-shaped packet. He divided the packet into three parts, and gave one to Mr. Baker, the other to the Public Analyst, and the third portion he produced. The assistant said, in the presence of the defendant, that he charged 3½d. for the sugar and 4½d. for the coffee. Mr. Baker then said he always sold pure coffee for 1s. 6d. Pure coffee is generally sold for 1s. 4d., 1s. 6d., and 1s. 8d., and chicory 5d., 6d., and 7d. In reply to Mr. Bell, the witness said he would not swear that he said to the assistant, "It is a good job we have not got you to deal with in this case to swear falsely." Witness wished to explain that the assistant said something to him which induced him to give the answer. Mr. Bell: Then he does admit it. The Bench asked the witness if he did make use of the words, as he had denied his recollection of using them. Witness said he would not swear that he said them. Continuing, he said he was not aware there were three compartments in the canister the assistant took the coffee from. He was paid by the Corporation. Mr. J. Brierly, the Borough Analyst, was called, and his analysis showed that the sample sent was 50 parts coffee and 50 chicory. In reply to the Bench, the witness said it was difficult to tell the precise amount of chicory in coffee beyond a certain point. On behalf of the defendant, Mr. Bell raised the question as to whether the sale was completed at the time the defendant said the contents of the packet were chicory and coffee. The Bench, desiring to hear the case further, Mr. Bell said it was obvious from the evidence of the first witness that the purest quality coffee was given at first, but that he, not having enough money to pay for it, was served with the mixture, and the paper covering showed what were the contents. Further, before the purchaser had the change, Mr. Baker put his hand down on the packet and said the contents were the mixture. Mr. Bell therefore contended that there was no fraud against the purchaser. He called the defendant, who deposed that the canister that had been referred to had three compartments, containing two different priced mixtures and pure coffee. At the time he entered the shop the coffee was on the counter, and he put his hands on it and on the change while he said to his man, "What did you sell this for?" The man replied, "Chicory and coffee, in printed paper." Witness asked the boy whom the goods were for, and Mr. Collis shouted, "It is mine." He (witness), however, said, "You have not the change; the purchase is not complete." Collis then said, "It is too late." Witness afterwards let the purchaser have the goods, as he had explained that it was mixture, and Mr. Collis began to divide the coffee. John James Brown, assistant to the defendant, corroborated his employer's evidence. The Mayor stated that the Bench had given this case great consideration, and they thought that coffee very considerably adulterated with chicory was sold for pure coffee. He would be fined 40s. and costs, or, in default, fourteen days. Mr. Bell begged to give notice of appeal, and the Bench bound over the defendant in the sum of £100 and two securities of £50 each to prosecute the appeal at the sessions. The money was afterwards paid.

Mr. Edward Thomas Wise, grocer and provision dealer, East Street, was summoned for selling coffee to G. H. Collis, which was not of the nature, substance, and quality demanded. The Town Clerk again prosecuted, and Mr. Bell defended. William Harvey said that on February 3rd he went to defendant's shop, and purchased of the assistant one pound of sugar and a quarter of a pound of coffee, the former for 3½d. and the latter for 4d. The sugar and coffee were ready in packets, and handed to witness, and he paid for them with 1s., receiving 4½d. in change. Witness told the assistant the goods were for Mr. Collis, and then the latter said (alluding to the packet of coffee), "This is chicory and coffee," and attempted to take it up, but witness forestalled him. Mr. Collis came in, and witness put the sugar and coffee on the counter for him to divide. The assistant neither called his attention to the paper covering the coffee, nor did he say that the contents were chicory and coffee. In answer to Mr. Collis, the assistant said Mr. Wise was not on the premises. Cross-examined: It was not until Mr. Collis had commenced to open the packet of coffee to distribute it that the assistant called his attention to the words on the paper-covering, "This is a mixture of chicory and coffee." Mr. Collis proved receiving the articles purchased from the last witness. He was proceeding to divide the coffee, when the assistant said "I have sold it all right; I have sold it as chicory and coffee," and he called witness's attention to the label. The analysis made by Mr. Brierly was put in, and showed that the sample analysed was sixty parts coffee and forty parts chicory. Mr. Bell submitted, for the defence, that the boy was the purchaser, and it was the actual purchaser who must make the statement to the seller, "I have bought this to be analysed." He should submit evidence to prove that the assistant stated in distinct terms that the article he was selling was chicory and coffee, and that would be an oath against that of the boy Harvey. As the burden of proof was on the complainant, he therefore claimed that the case should be dismissed. Albert Kirby proved serving the boy Harvey with some sugar and coffee, telling him that the prices of the mixture were 1s. and 1s. 4d. per pound, and the pure coffee 1s. 8d. The lad then asked for the fourpenny. After serving the lad, and before giving him the change, witness told him that if he wanted pure coffee he would change it, but Harvey immediately picked the packet up. Cross-examined by the Town Clerk: The 1s. mixture consisted of 65 per cent. of chicory, and the 1s. 4d. mixture contained more coffee—about 75 per cent. This concluded the evidence, and the Mayor said the case appeared similar to the last, and the defendant would be fined 40s. and costs, or fourteen days' imprisonment in default.

NOTES OF THE MONTH.

In our last number appeared a report of a case of flour adulteration which was heard at Eckington, in North Derbyshire. In this case the certificate was worded as follows: "The sample was adulterated with alum. I estimate the proportion of alum added at about 24 grains to the four pounds of flour. This is a somewhat smaller proportion than that commonly employed. Alum is added to flour of inferior nutritive value to cause the bread made from it to simulate in whiteness and apparent quality that made from the best flour." It will be observed that while Mr. Allen certifies positively to the presence of alum, he clearly shows that the amount found is based on an "*estimate*," which may not be strictly accurate.

It will be in the memory of our readers that, in consequence of the evidence given by the chemist called by the defence, the third portion of the sample was sent to Somerset House. Thence a certificate has been received, signed by Messrs. Bell, Bannister & Helm, stating that "we have analysed the same, and declare it to contain not less than 18 grains of alum per four pounds of flour." This is a substantial confirmation of Mr. Allen's certificate; but we think it would have been more satisfactory if the Somerset House chemists had stated how much alum they believed to be present, instead of giving the absolute *minimum amount*, without mention of the maximum.

Our versatile contemporary, the *Grocer*, having completed its review of the German reproduction of the researches of English Public Analysts on the Analysis of Tea has been treating its readers to their periodical dose of diluted science. That our contemporary should take a special and fatherly interest in, and do its best to circulate, productions remarkable for being largely diluted, is only natural; but the article entitled "Ridiculous Adulteration," which appears in the number for March 6th, is unapproached in absurdity even by the numerous attempts in that direction with which our contemporary's pages have rendered us so familiar. In the article in question, the *Grocer* takes Mr. Allen to task for asserting that alum is used to improve the quality of flour, especially in bad seasons. "When they tell us openly, deliberately, and under oath that the $\frac{1}{1148}$th part of alum is added by millers or flour merchants for the purpose of improving inferior flour, and enabling them to palm it upon their customers as a superior article, what must be the mental condition of analysts?" "We should like to know how it operates on the buyer, in order to deceive him, when he examines the sample." "If Mr. Allen had found 4 or 5 per cent., or anything like a commercial quantity, of alum or alumina in the flour, it would be mere hair-splitting and special pleading to talk about dust at all." "We are bound to protest, in the name of common sense, against the assumption that vendors of flour defraud their customers by mixing with the genuine article such a quantity as $\frac{1}{4832}$nd part of its bulk of alum crystals, the which crystals alter the quality, or apparent quality, of the flour, and deceive the purchaser by merely lying amidst the particles of flour, without undergoing any chemical change whatever."

"In the name of common sense," why did not the *Grocer* have a talk with a miller before publishing such a tissue of false arguments. Any miller would have told the writer that the addition of a quarter of a pound of alum to the sack of flour would raise the selling value of that flour by about 1d. per stone, and hence there is ample inducement to adulterate. ¼ lb. of alum to the sack is 28 grains to 4 lbs., $\frac{1}{1000}$th part by weight, or $\frac{1}{2000}$th part by measure. This quantity is therefore but slightly in excess of the amount found by Mr. Allen in the Eckington flour. In the Retford case, reported on another page, the miller was in the habit of using "three handfuls of alum in every sack of flour." Here we have a larger, but still very small, proportion of alum. Four or 5 per cent.—the "commercial quantity" suggested by the article in the *Grocer*—would be 10 or 12 lbs. to the sack! Seeing, therefore, that the quantity found was stated in the certificate to be somewhat less than the proportion usually employed, and was clearly "anything like a commercial quantity," common justice ought to cause the insertion in the *Grocer* of an apology for having, in ignorance of the subject, created an erroneous impression.

A somewhat amusing scene is reported in a paper which has been sent to us, as having occurred between Dr. Tidy (who, it will be remembered, was one of the defence witnesses in the Alum in Baking Powder case) and the West Ham Local Board. The learned doctor, it seems, had received a number of samples, but had not thought proper to give certificates until too late to prosecute. In excuse for this, he alleged, *inter alia*, that there were many things a man in large practice had to do, and that he was not aware of the 28 days' limitation in the Act, but at the same time he offered to resign. It is, we think, a great pity that he did not resign and have done with it, because a man in such large general practice as to forbid his even making himself master of the requirements of the Act, to work which he is appointed, is surely wrong in continuing to pretend to carry out the duties of his office. The retaining of the post of Public Analyst by anyone who does not give his immediate and careful attention to every sample he receives, and who neglects to report thereon "with all reasonable speed" is a farce, which had better cease, both in the interests of the analyst himself and the public.

During the discussion, Dr. Tidy is also reported to have said, "It is not my wish to be troublesome; but there is one thing I shall set myself against, and that is, mere prosecutions for the sake of prosecution. I abominate the thing, and if ever I was thought to pass over samples, it was because I saw that action would be merely harassing to trade." To this, Mr. Helmore, a member of the Board, very neatly and appropriately replied that "the Board expected to receive a correct analysis from him, leaving it to the Board to judge as to whether it is a case to prosecute or not." We commend Mr. Helmore's advice to the learned doctor, and advise him in future to do what a good cobbler should, viz., stick to his last, and not invite articles in trade journals, discrediting the whole body of Public Analysts by arrogating functions which the Act does not give him.

We have received letters complaining of the conduct of one of the members of our Society, who calls himself a "Public Analyst," although he holds at the moment no appointment. Such a course is clearly wrong, and the gentleman in question will doubtless see this, and substitute "Member of the Society of Public Analysts" for the bare words "Public Analyst" on his printed headings until he obtains office.

Mr. W. Johnstone, F.C.S., has been appointed Public Analyst for King's Lynn, *vice* Mr. W. M. Hamlet, resigned.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price
2809	J. Hargreaves	Manufacture of Sulphates of Soda and Potassa	6d.
2839	W. E. Hartmann	Manufacture of Sulphuric Acid	6d.
2939	E. Carey and H. Gaskell	Purification of Alkaline Solutions	6d.
2983	F. Wirth	Manufacturing White Lead	6d.
3003	W. L. Wise	Treating Sugar Cane	6d.
3077	E. De Pass	Application of Bisulphite of Lime for Manufacturing Sugar	4d.
3125	W. McDonnell	Abstracting Colour from Annatto or Arnatto	2d.
3194	W. Weldon	Obtaining Sulphur from a Lye-product of the Manufacture of Alkali	4d.
3195	W. L. Wise	Producing Caustic Alkalis and Preparations of Alumina	6d.
3196	S. T. Thomas	Manufacture of Phosphates	4d.
3200	G. H. Ogston	Softening Water and obtaining Fertilizing Compounds	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practioner; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts *Journal.*

THE ANALYST.

MAY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

An Ordinary Meeting of this Society was held on Wednesday evening, the 14th April, Burlington House, Piccadilly. In the absence of the President, Dr. Dupré, F.R.S., took e chair.

The Scrutineers having examined the voting papers, reported that the following ntlemen had been duly elected as Members :—

F. A. Bond, M.B., &c., Brincklow, Coventry.

J. Napier, Public Analyst for West Suffolk, &c.

H. S. Carpenter, Analytical Chemist, Holborn Viaduct.

Mr. J. J. Eastick, Analyst to Fieldgate Sugar Refinery was proposed as a Member, d will be balloted for at the next Meeting.

The following papers were then read and discussed :—

"Some Results of the Analysis of various Tinned Food Products," by G. W. Wigner, .C.S., and Mr. Wigner also gave some further particulars as to the "Work Done during 879 under the Sale of Food and Drugs' Act."

"Note on a Fibrous Substance found in the Intestine of a Sheep," by Bernard Dyer, .C.S.

"Notes on Cream of Tartar," by A. H. Allen, F.C.S.

"On the Manufacture of Citric Acid," by J. Carter Bell, F.C.S.

The next Meeting will be held at Burlington House, on Wednesday, 2nd June next.

ON THE WORK DONE BY PUBLIC ANALYSTS DURING 1879 UNDER THE SALE OF FOOD AND DRUGS' ACT.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 17th March, 1880.

HE returns which have been furnished, in response to the application of the Proprietors f The Analyst, by Members of our Society and by a few other Public Analysts who are ot members, but who take an interest in this annual statement, enable me this year to lay efore you much fuller statistics as to the amount of work which has been done under the ale of Food and Drugs' Act during 1879, than has been possible in any previous year. hese detailed results are shown in the annexed table.

In 1877 we received returns from 127 districts; in 1878 from 168 districts; while is year we have returns from 212 districts. There is an apparent increase in the number f samples analysed during 1879 of about 2,500 samples, but this is, probably, mainly due the fact that there are so many more returns.

It is rather unsatisfactory to note that the general average shows a slight increase in e proportion of adulterated samples, the percentages shown by the returns of various ears being as follows :—

In 1872	26·0 per cent.
1875 & 6	18·10 „
1877	17·70 „
1878	16·58 „
1879	17·25 „

I cannot trace out any special cause for this increase, and it will, therefore, be well to consider it first in reference to the different classes of samples. The total number of samples examined in these 212 districts has been 17,574. Omitting Somersetshire, as to which we have received no details, these samples have been divided as follows:—

Milk	6036 =	36·1 per cent.
Butter..	969 =	5·7 „
Groceries	4197 =	25·0 „
Drugs	615 =	3·6 „
Wine	1615 =	9·7 „
Bread	1471 =	8·7 „
Water	1240 =	7·5 „
Sundries	629 =	3·7 „
	16,772	100·0 per cent.

The next point of interest, is to notice how the various classes stand as regards the percentages of adulteration, as compared with those which were shown by the same classes of goods in the previous years, the percentage in each class being calculated on its own class total, and not on the general total of samples analysed.

	1877	1878	1879
Milk	26·07	18·38	22·06
Butter	12·48	13·23	13·93
Groceries	13·00	12·89	11·73
Drugs	23·82	35·77	26·66
Wine, &c.	47·00	29·31	28·30
Bread	6·84	2·97	4·62
Water..	21·63	14·98	21·45
Sundries			10·17

From these figures it will be seen that wines and spirits, which occupied the worst place in 1877, with 47 per cent., and fell in 1878 to 29·3 per cent, now shows the worst place of all, 28·3 per cent. being adulterated. Of course this includes, as before, those samples of spirits which were returned as watered, but as a limit has been laid down by The Sale of Food and Drugs' Amendment Act, which is lower than had been previously customary in many districts, I think we must come to the conclusion that the degree to which the spirits were adulterated was probably considerably greater during 1879 than in 1878.

Next on the list come drugs, showing 26·66 per cent. adulterated, as against 35·77 in the previous year. The difference is very great, but it must be borne in mind that this year comparatively few samples of violet powder are included, and the result is, therefore, probably a more near approach to a fair average. Of course by this I do not mean a fair average of all the drugs sold, because the inspectors naturally purchase most frequently those kinds which are more likely to be inferior or impure. The most noticeable remark in the returns, as to drugs, is one relating to so-called quinine wine, which contained no quinine at all. This was in the County of Antrim.

Milk shows a considerably increased percentage of adulteration—3·68 per cent.

more than in 1878. It is difficult to trace this increase to any other cause than the extremely low fines which are generally thought sufficient in cases of milk adulteration. It really is a serious matter that more than 22 per cent. of the samples of milk purchased by inspectors, who are in almost every case well known and recognised, should turn out to be adulterated, even when judged by the low limit adopted by the Society. Two cases which have been reported appear of some special interest here. In one case at Margate, Mr. Harvey tells us that the defendant pleaded that the milk was taken from a particularly poor cow, and the case was adjourned in order that the inspector might procure a sample from this cow. This was done and the sample was analysed, with the result of solids not fat 9·46 ; fat 2·75, and the defendant was, in consequence, heavily fined, as he deserved.

In another case, Mr. Carter Bell refers to a defendant pleading that, owing to the deficiency of grass, &c., his cow had been fed entirely upon hay, and the plea was so far successful that the magistrates acquitted him; whereupon the next defendant, determined not to be outdone, pleaded that his cows had been fed entirely upon *straw*, and, in consequence, he also was acquitted. Mr. Bell thinks this case suitable for investigation by the Society for Prevention of Cruelty to Animals.

Butter appears to show a continued increase of adulteration, the percentages for 1877, 1878, and 1879, respectively being 12·48, 13·23, 13·93, or an increase of almost exactly ·7 per cent. per year. It is, perhaps, hardly fair to attribute this to greater accuracy in butter analysis, because even in 1877 the methods were sufficiently well understood to make it certain that few adulterated samples would be passed as genuine; while on the other hand, it is a notorious fact that the make of butterine has greatly increased during the past two years, and the figures point to the opinion that the sale of butterine under the name of butter has become more common. The number of samples examined during 1879—nearly 1,000, is sufficient to prevent any idea of an unfair average being drawn.

Groceries show a decided improvement on the two previous years, the reduction in the amounts of adulteration being 1·16 per cent., but still the present figure is far too high. Doubtless a large proportion is due to the sale of chicory and coffee under the name of coffee, and other similar practices, but even shutting out those samples, which are probably from this cause returned as adulterated, the remaining percentage is much greater than it should be.

Bread and flour again show a change for the worse; in this particular case the increase may be more apparent than real, and is due partly to the improved method of analysis devised by Dr. Dupré, which, although it has unquestionably proved some samples to be genuine, in reference to which considerable doubt would otherwise have been felt, yet has on the other hand enabled the presence of alum in flour to be detected in some cases with absolute certainty where, without this process, suspicion only could have been entertained.

This year our correspondents have, at some trouble to themselves, separated the samples of water from the sundries. As we have so often pointed out before, water does not really belong to the work done under the Act by the Public Analyst, and should in no case be undertaken by him except for a separate and special fee or a larger salary than would otherwise be accepted, nor should he even then issue certificates on the forms provided for in the Schedule to the Act. It is, of course, quite right that the water analyses of the district for sanitary purposes should be done by the Public Analyst, but it is undesirable that in any case he should view it as part of his official duty. In consequence of this separation of the waters, the sundries show the very considerable reduction in the percentage of adulteration of 4·81 per cent.

Considering next the proportion of adulterated samples of each class calculated on the total number found to be adulterated, we find that altogether there were 2978 samples adulterated, the description of which has been particularly reported to us, and these were divided as follows:—

The Milk Samples adulterated were	1332 or	44·72 per cent.
„ Butter „ „	135 „	4·53 „
„ Groceries „ „	492 „	16·52 „
„ Drugs „ „	164 „	5·52 „
„ Wines, &c. „ „	457 „	15·36 „
„ Bread „ „	68 „	2·28 „
„ Waters „ „	266 „	8·93 „
„ Sundries „ „	64 „	2·14 „
	2978 or	100·00 per cent.

Viewed in this way the table shows, as the table for the previous year did, that milk, butter and bread show a larger percentage of adulteration this year than they did before, the increase in the case of milk being 2·57 per cent.

The percentage of adulteration in different districts is of much interest. Norfolk nominally heads the list, but as the majority of the samples are waters, I will not take account of that here, but pass on to Margate, which really heads the list with 72 per cent. of adulterated samples—entirely milks. At this rate we may certainly commiserate the children who are fed on Margate milk. Southampton and Glasgow follow pretty closely with 60 per cent. adulterated, and South Shields shows more than 50 per cent. of adulteration, Derbyshire having 44 per cent. Bermondsey and St. George's, Southwark, each show 34 per cent., while in the adjoining district of Wandsworth, with the same analyst, the rate is only 8·25 per cent. Hampstead shows 6 per cent. and Lewisham 22 per cent., both of these places again having the same analyst. The City of London shows 30 per cent., although on the very small total of 49 samples, while the remaining Metropolitan districts which have been reported show an average of about 14 per cent., a figure which is pretty closely adhered to in Cheshire, Dublin County, Limerick County, Sligo County, Manchester, Cumberland, Brighton, Northumberland and Yorkshire generally, while in Staffordshire, Isle of Wight, Sussex, and Somersetshire, the percentage of adulteration is still less, averaging rather under 10 per cent.

From these we pass to the counties and towns in which very few samples have been analysed, so few, in fact, as to render the Act nugatory. There are fourteen counties, towns, and districts, having a gross population of very nearly one million, in which only 66 samples were submitted for analysis, or an average of less than 5 per place. These are Chesterfield, Montgomery, Carlow County, Cavan, Waterford County, Macclesfield, Ramsgate, St. Martin's, Carmarthen Borough, Chichester, Newington, Bury St. Edmund's, Ipswich, and Radnor County. In this respect the returns seem worse than last year.

Referring to another feature in the table, it appears that in Andover, Barnsley, Stalybridge, Wenlock, Lancaster, Helmsburgh, Falmouth, Launceston, Penzance, Truro, Ashton-under Lyne, Pontefract, Richmond, Ripon, Wakefield, Deal, Faversham, Sandwich, Ryde, Stratford-on-Avon, Warwick, Gloucester, Hereford, Falkirk, Stirling, Airdrie, Stewarton, Brecon Borough, Cardigan, Neath, Pembroke, Tenby, Tenterden, Suffolk, Penryn, Berwick, Durham, Tynemouth, Maidenhead, Monmouth, Droitwich, New Radnor, Birkenhead, Kilmarnock, Rutherglen and Sutherlandshire, or altogether 2 counties and 44 towns, with a population of about 1,000,000, no samples whatever have been analysed. In the table for 1878 there were 37 places in this condition; therefore the number has apparently increased by 9 during the year, and this notwithstanding the action which the Local Government Board have been taking to compel authorities to enforce the Act. It is well to point out here that it is the duty of every Public Analyst in accordance with the Act to make a quarterly report to the authority appointing him, even when he has received no samples for analysis, and this authority or their clerk are bound to forward copies of each year's quarterly reports to the Local Government Board. By this means the central authorities are kept informed year by year, and unfortunately not oftener, of the neglect of the officials in those districts who have so far complied with the Act as to appoint an analyst, but do not seem inclined, unless pressure is put upon them from higher quarters, to do anything more.

After the President had thanked Mr. Wigner for the trouble he had taken in compiling the returns,

Dr. Dupré said that, as Public Analysts were aware, the Inland Revenue Report for the year ending March, 1879, had recently been published. It included the Report of the Principal of the Somerset House Laboratory, who stated that 21 samples were referred to that department by magistrates under the Sale of Food Act. In 8 of these cases he came to a conclusion different from that of the Public Analysts, and he gave two instances which he thought of sufficient interest to describe. One was a sample of flour which had been stated to be adulterated with alum, and although he agreed with the Public Analyst as to the amount of alumina present, he could find no evidence of its existence as alum, but "on the contrary, the results of the experiments conclusively pointed to the absence of alum, and the unusual amount of silica found indicated that the alumina was present as an impurity in the form of clay." He (Dr. Dupré) would like to point out in regard to this that at the time the Inland Revenue certificate said nothing whatever about silica; and still less about its relation to the amount of clay present. Indeed, up to the present he (the speaker) had believed that the relation between silica and clay in flours, and its bearing on the estimation of alum in flour and bread, was first pointed out by himself some time afterwards. The next was a whisky case, where some Public Analyst reported it to have consisted of diluted alcohol coloured with burnt sugar. They did not agree with this, and stated that "we found that the sample was what is known as neutral spirit, or patent still whisky, which had been coloured and flavoured with wine. This is a kind of whisky which is almost entirely free from fusel oil, and consequently, while more deficient in character than some whiskies, is yet less dangerous to the health of the consumer." He (Dr. Dupré) said it was absolutely impossible for any chemist when dealing with a weak spirit free from fusel oil, to state positively that he was not dealing with alcohol which had been diluted and flavoured. The Inland Revenue chemists could therefore have had no chemical reasons for upsetting the analyst's certificate. The utmost they could have said was that it might be diluted alcohol flavoured, as stated, but that it also might be weak spirit free from fusel oil flavoured with wine. How, even in this latter case, it could be called whisky, he failed to see. In a subsequent part of the Report relating to beer, the Principal referred to a case where a brewer was prosecuted for having added sugar to the wort. One of the members of the Society appeared against the Inland Revenue chemists, and had examined a sample of the wort which was several months old, and although it had altered very slightly or not at all, still there was that objection to it. This analyst stated that there was no cane sugar in it, and the Inland Revenue Chemists remarked: "In this the chemist who analysed it was no doubt right as the sample was then three months old, but he added the very remarkable statement that the sample was as fresh and undecomposed as when first brewed, and that if cane sugar had ever been used, it must have been found by him. In this evidence there must have been a serious mistake, as all who know anything of the composition of malt wort are aware that when it is bottled and kept under ordinary circumstances, it will only remain for a very short time without undergoing decomposition, the first effect of which is to invert the cane sugar, if any be present." If this sentence has any meaning, it implied that after the cane sugar had been inverted it could not be found out whether cane sugar had ever been added to the malt wort or not, whereas that was an entire mistake. Cane sugar, after it has been inverted, turns to the *left*, about one-sixth as strongly as maltose turns to the *right*. Maltose reduces Fehling's solution about two-thirds as much as invert sugar. A combined optical and chemical test would therefore readily show the presence or absence of invert sugar. But chemical test alone would suffice. If when dealing with pure maltose it was estimated chemically, and then converted into dextrose by heating with an acid, 100 parts became 150.

When dealing with maltose, plus a certain quantity of cane sugar, the 100 became rather more than 150 after heating with acid, because the maltose which gave 100 was alone measured in the first instance, and that was made into 150, in addition to which the cane sugar, not estimated at first, became invert sugar, which of course reduced a certain proportion of copper solution. Therefore, in the presence of cane sugar, 100 of maltose will make more than 150 of dextrose.

If dealing with maltose, plus a certain amount of invert sugar, the 100 measured chemically was made into less than 150, because the 100 measured chemically consisted of a certain quantity of maltose and a certain proportion of invert sugar, and only the maltose was converted, which is assumed to be less than 100, into its proportion as to 150.

If, then, in a wort which had been kept the sugar on conversion into dextrose increased in the proportion of 100 to 150, they were perfectly justified in stating that that wort did not then contain, and could never have contained, any appreciable amount of cane sugar.

Dr. Bartlett pointed out that it was unusual to have a considerable amount of inverted dextrine where the solids of beer were entirely composed of malt, but this was not always the case. There was now a large sale of other saccharine matters, and he was acquainted with brewers who used cane sugar or invert sugar, and that takes the place of malt extract; how then would come out the calculation laid down by Dr. Dupré? He meant that, if in the first instance that the solids were composed of malt extract one-third, and cane sugar two-thirds, there he thought the ground laid down for calculation by Dr. Dupré disappeared. He thought the matter was of considerable importance, and one very likely to crop up before the members of that Society.

Mr. Hehner said he was not ashamed to own that he was the chemist alluded to in the malt wort case, and would first like to say that it was not, as might perhaps be supposed, a Public Analyst case, but one in which he was engaged privately. With regard to the case itself, there was certainly a doubt about the identity of the sample, but that must be attributed to the Excise officers themselves, who bottled the samples without securing the cork by any seal. His sample was taken by the inspectors whilst it was very hot, and it therefore had a chance of keeping some length of time. It possessed the same specific gravity, the same acidity, and so on, as the Inland Revenue chemists' sample, and he believed, that as far as the chemical evidence went, the samples were identical. It would have been practically impossible for the brewer to substitute for the original sample, had it been sugared, another genuine one, showing practically the same gravity, acidity, &c. The difference was chiefly in the interpretation of the results. The Inland Revenue chemists, as far as he could learn, simply took a measured quantity of the wort and boiled it for a few minutes with a drop or two of acid, any increase in the copper reducing power being taken to represent cane sugar, the dextrine and maltose not being supposed to undergo any change. From a large number of experiments made by him upon pure malt worts of different strength, and obtained under widely different conditions, Mr. Hehner could, however, state most positively that some inversion invariably took place even after a very short time of heating and with very little acid, and in exceptionally strong worts, such as the one forming the foundation of the case, this inversion might amount to several percentages calculated as cane sugar. At the same time he would admit that cane sugar was inverted with extreme facility, whilst the total inversion of malt worts was a very difficult matter, even when 10 per cent. of strong hydrochloric acid were employed. He still believed that the sample was perfectly genuine, and that, anyhow, the presence of cane sugar had by no means been conclusively proved. The Excise Chemists ridiculed the proposition that the cane sugar should have been separated from the wort in the crystallised state and produced as *corpus delicti*, and said this was quite impossible. Mr. Hehner, however, said it had been done in other cases, and he himself was ready to do it. What grounds the Inland Revenue Chemists had for saying in their Report that he had made a serious mistake he could not understand, especially as at the hearing of the case they disputed the identity of the sample. He still adhered to the opinion he expressed at the time—though then, perhaps, too strongly—that the brewer had been subjected to a grievous wrong.

THE PROPOSED AMERICAN PHARMACOPŒIA STANDARDS.

By John Muter, Ph.D., F.C.S.

A report has been just issued on the revision of the *U.S. Pharmacopœia*, preliminary to the Convention of 1880, being a rough draft of the general principles, titles, and working formulæ proposed for the next *Pharmacopœia*, prepared and compiled by Charles Rice, chairman of the committee of revision. This interesting document (which is not for sale, but of which a copy can be had by any interested professional man on application to George Ross, Lebanon Pa., U.S.A.) is a most gratifying instance of the able efforts of our American cousins to advance and perfect their official standards. The many evidences of painstaking research contained in the voluminous report, extending in all to 200 closely printed pages, reflects the greatest credit on Dr. Rice and his coadjutors. Into the pure pharmacy of the report it is scarcely my province to enter, although I may say broadly that it will well repay deep study and careful criticism at the hands of those responsible for the next edition of the *British Pharmacopœia*. The point which to us, as analysts, is the most interesting, is the careful way in which the tests for valuation of alkaloids and their preparations have been worked out. Compare, for example, our crude official method of single precipitation with ammonia and drying, with the following test for quinine in the *ferri et quinæ citras* scale :—Dissolve four grams of the scales by heat in sufficient water, and when cool transfer the solution to a glass separator, rinsing the dish; add a solution of half a gram of tartaric acid, and then solution of soda in decided excess, and extract the alkaloid by well shaking with three or four portions of water-washed chloroform of 15 c.c. each. Evaporate the chloroform in a weighed dish and dry the residue at 100° C. Lastly, extract the residue with forty times its weight of pure ether, when it should dissolve practically without residuum. The addition of the tartaric acid is to prevent separation of ferric hydrate on shaking up with the soda. The process adopted for the valuation of the barks is that of De Vrij, but the estimation of quinine by mere extraction of the total mixed alkaloids with ether is very properly objected to as entirely fallacious, and the crystallization process as sulphate is given, which is undoubtedly the true one for a real valuation of the bark for commercial purposes. It is no uncommon thing for a manufacturer, who trusts to the analysis of persons who use the simple ether abstraction of the mixed alkaloids, to find in practice that he has bought an article which contains a quantity of amorphous quinine weighed by the analyst as actual quinine. Not only is the present system of weighing the whole ether residue and calling it quinine bad, but there really ought to be some recognised allowance off the crystallizable quinine, just as in sugar analysis an allowance off the crystallizable sugar is made according to the amount of uncrystallizable sugar present. If this were done, manufacturers could really get from the bark the amount shown by the analysis. It is a matter of some wonder that the method of extraction by percolation with ·735 methylated ether, after treating with dilute spirit and lime and drying, has not been noticed by the reporter, Professor Prescott, because, although De Vrij's extraction is undoubtedly the best for red and pale Indian barks, the value of which depends on the other alkaloids as well as quinine, yet in the case of a *yellow* or an *officinalis* bark, where quinine only is required, the direct process with ether leaves nothing to be desired. The only difficulty is the recovery of the large bulk of ether necessarily used, but that is now rendered most simple by Mr. Wynter Blyth's ingenious apparatus, and the process is not only easily completed in 24 hours, but requires a minimum of attention. Another point in the estimation as sulphate has been looked over, which is of great importance in issuing instructions such as are supposed never to fail even in inexperienced hands, and that is the use of a definite amount of weak volumetric sulphuric acid to dissolve the quinine, so regulated that although a certain portion be first used and then so many other portions be afterwards employed to wash the animal charcoal, yet on neutralizing with ammonia and evaporating to a given low bulk, no crystals of ammonium sulphate can ever separate at a temperature of 15° C. These suggestions are, it appears to me, worthy of note by revisers of the *Pharmacopœia*.

The process recommended for the estimation of opium is that of preliminary percolation of 6½ grams of dried opium with benzol, heating in a weighed flask with a definite *weight of water* and 3 grams of freshly slaked lime, and restoring the original weight of the whole with water. The whole is then thrown upon a filter and a definite weight of the filtrate is taken representing 5 grams of the original opium agitated with 8 drops of benzol and 3 c.c. of pure ether and the morphia caused to crystallize by the addition of 4½ grams of powdered ammonium chloride. Lastly, the crystals are washed with pure ether and dried at 50 °C. As to this process some objections have been lately raised, mainly that the benzol is not perfectly without action on the other alkaloids besides narcotine, and therefore it is good to observe that Professor Flückiger's process, given originally in the *German Pharmacopœia Report*, is also referred to. In my own experience this latter is really the most desirable, and as now finally modified by the author it is in every respect a useful one. As many of the readers of The Analyst may not have yet used it, I give it in full, and I think that exactly followed they will find it easy to work, and giving always concordant results. Eight grams of *dried* opium are repeatedly extracted with *absolute* ether, and the residue allowed to once more dry by exposure to the air. The residue is then treated in a closed flask with 80 grams of water for 12 hours with frequent agitation, and the whole is thrown on a ribbed filter of 5 inches diameter, and 42·5 grams of the filtrate weighed off for analysis in a small previously weighed flask of 100 c.c. capacity. To this 12 grams of ·815 alcohol and 10 grams of ether are added, together with 1·5 gram of liquor ammonia ·960 sp. gr. The flask is closed, shaken, and set aside for 24 hours. After agitating so as to detach the crystals from the flask, the whole is thrown on a 4-inch ribbed filter and washed out, first with 10 grams of alcohol-ether mixture, and then with 10 grams pure ether. Lastly, the crystals are transferred back to the flask in which they are dried and weighed. The weight multiplied by 2 and then by 20 gives the percentage of $C_{17}H_{19}NO_3.H_2O$ in the original opium.

A very wise precaution on the part of the committee is the suggestion that all opium shall be considered to contain exactly 10 per cent. of morphia in the dried state, and if it contain more a proportionate dilution in strength shall be directed according to a definite method before any preparation of it be made. Having thus shortly glanced at some points of interest to analysts in the report, I heartily recommend it to the perusal of persons interested.

SOME RESULTS OF THE ANALYSIS OF VARIOUS TINNED FOOD PRODUCTS.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 14th April, 1880.

HE use of American and Australian tinned goods and other food products has extended eatly during the last year or two. The high price in this country of many articles of d, as compared with their value abroad and in the colonies, has been gradually forcing m forward into more general consumption, but in addition to this it is evident that more e and skill have been brought to bear on the preparation and packing of the goods, and t they have consequently been offered for sale in better condition and in more attractive m.

At present little has been done except in the form of advertisements to familiarize the glish consumer with the value and advantages or disadvantages possessed by these eign goods. In one or two cases, and notably in *A Year's Cookery*, which was reviewed The Analyst a short time since, and in a series of articles by Mr. Ernest Hart, which have appeared in the *British Medical Journal*, the practicability of making palatable and nutritious dishes from these products has been considered, but I have never met with any careful examination of them which gave any information as to their food value.

I propose to lay certain results of this character before the Society to-night.

The cooked foods which I have analysed have been selected by their general indications of care in packing and the good and sound appearance of the tins. Those brands which were in tins of bad colour, and which appeared therefore more likely to contain much lead alloy in the tin plate, were not chosen, and I have not considered it worth while to examine those which were of obviously inferior character in any other respect. Every article mentioned has been tested as a dish served at the table, either cooked or not as may be necessary, as well as by analysis. The prices are only approximately correct, for the profit which the retailer requires appears to vary much.

1. Roast beef.* In cylindrical tins, containing 1½-lb. net weight, inclusive of a small amount of strong gravy boiled to a jelly, with which the tin is perfectly filled. The analysis gave the following results :—

Moisture	60·73 per cent.
Albuminoid substances	18·93
Containing nitrogen 2·99	
Fat	17·77
Ash	1·68

Comparing this with the analysis of an average sample of raw beef free from bone it will be seen that the moisture is about 15 per cent. less than in raw beef and within 5 per cent. of that found in cooked lean mutton chop, and that a large proportion of the fat has been removed ; that is, instead of nearly 30 per cent. of fat there is less than 18 per cent. The true albuminoids are nearly 17·8 per cent. against about 15 per cent. found in raw beef free from fat. The ash is nearly 1·7, or as nearly as may be identical with raw beef. This roast beef, therefore, is, as regards dietetic value, as shown by analysis, some 10 to 20 per cent. more valuable than uncooked lean beef, quite free from bone, and only slightly less valuable than cooked steak. The tins should retail at about 1/0 each. This would be equal to 8d. per lb. for cooked, boneless meat ; or say, 6⅓d. per lb. for raw meat, without bone. If the tin is cut open the meat comes out in a solid of the shape of the tin, and if served as a cold dish, it is of excellent flavour, and firm enough to cut well. It does not do equally well when warmed up, because the stock with which the tin has been filled up melts to gravy. For hashes, stews, or pies it answers well, but as it is already sufficiently cooked, it obviously needs care to avoid overcooking before sending to table.

2. Boiled Beef. This article is sent out in tins which are slightly conical in shape, so as to facilitate emptying the contents in a compressed form. The fat is low, 8·5 per cent. ; water 50·6 per cent. ; while the nitrogen is increased to 3·80 per cent., corresponding to 24·07 per cent. of albuminoid substances. This article is therefore shown by the analysis to be a good sample of cooked meat, fully 20 per cent. more valuable as a food than raw lean meat ; it certainly serves up well at the table. It is sold in several sized tins, and the net retail price comes to about 7d. per lb. on the cooked meat, or a fraction over 5d. per lb. on raw beef, free from bone.

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* As the quality of tinned beef varies considerably, I may mention that this sample was marked "*Thurbers.*"

3. Boiled chicken. In cylindrical tins, almost free from bone, weighing about 1½ lb. net, including a small proportion of stock put in to fill the tin. The larger bones are entirely absent, and there is a smaller proportion of the dark coloured flesh of the legs than in the entire fowl. The results obtained were—

Moisture	53·00 per cent.
Albuminoids	24·00 ,,

The average water in the flesh of chicken free from bone is variously quoted at from 73 to 77 per cent., and the different analyses show albuminoids varying from 17 to 21 per cent. The cooking in this case also has therefore been satisfactory, and it is fair to estimate the food value as about 25 per cent. higher than the flesh of raw fowls. The flavour of this article was good; it was in the opinion of several who tried it even more palatable than ordinary cold roast chicken. The retail price is about 1s. 3d. per tin, or say 10d. per lb.

4. Mackerel. My experience with these has at present been unsatisfactory. For some reason this fish appears to take up the metal from the tins more readily than any other I have yet examined; so much so, that a slight metallic flavour has in one or two cases been found. The results of the analysis, except in this respect, have been satisfactory, showing—

Moisture	70·85 per cent.
Albuminoids	18·86 ,,
Ash	2·79 ,,

These figures included the whole of the liquor in the tin, and they correspond very closely with Payen's analysis of the flesh of the mackerel freed from bone. The tins might perhaps be improved in quality so as to make this a palatable article.

5. Lobster. In tins. The contents consist mainly of the harder parts of the flesh, *i.e.*, the claws, &c. The tins contained about 1½ lb. net weight, including the liquor, which was, of course, also included in the sample analysed. The results were:—

Moisture	77·16 per cent.
Albuminoids	18·42 ,,
Ash	1·90 ,,

I have not been able to find any previous analysis of the flesh of the lobster; but judging by the analysis of other shell fish there does not appear to have been any increase in water or loss of albuminoids. The sample was quite satisfactory in flavour, and at retail price costs about 6d. per lb. This certainly must be of value for food, and in flavour it was excellent, both for salad and when potted.

6. Baked Beans. These are a species of haricot bean cooked in the tin, with the addition of a slice of fat bacon. The cooking has apparently been steaming rather than baking, or at any rate the tins had been filled up with water so as to exclude the air. The entire sample, liquor included, contained

Water	68·80 per cent.

Ripe haricots by Church's analysis contain 14 per cent. of water. Therefore about 50 per cent. of this water has been introduced for cooking purposes. This proportion does not appear to be at all in excess of what is necessary for cooking beans in the ordinary way, but it has to be borne in mind that, contrary to the case of the meats, we get less raw material as the result of the cooking. Each tin contains about 2½ lbs., this would equal about 1¼ lb. of ripe haricots not cooked. Calculating on this basis, I find that the albuminoids in the beans containing 18 per cent. of water were 17·21 per cent., a figure which is rather lower than Church found in the fresh beans. It is, however, high enough to make them class as a good and nutritious vegetable food. There is sound judgment shown in cooking a piece of bacon with them, as haricots are naturally deficient in fat, and the bacon supplies this and also improves the flavour. I have used these much, and they have almost always been liked. The retail price is about 1s. per tin.

7. Peas. These are tinned in a similar way to the beans, and they consequently contain more water than ripe peas. I took a large sample, and after filtering them, evaporated the filtrate. The residue left, *i.e.*, the proportion dissolved by the water, was 1·11 per cent. This, of course, represents the proportion of the sample which would in ordinary course be wasted, because it would not be served at table. The total water was 58·3 per cent., so that as ripe peas contain about 14 per cent., about 45 per cent. had been added for cooking purposes. The albuminoids calculated on to the sample, with 14 per cent. of water, were 21 per cent., so that the loss of flesh-forming matter has certainly not exceeded 1 per cent. They are, therefore, probably quite as good for food as freshly cooked peas. The retail price is about 10d. per tin, containing about 1¼ lb.

I am carrying out these experiments on other products of the same class, and shall hope to bring the results forward at a future time.

NOTE ON A FIBROUS SUBSTANCE FOUND IN THE INTESTINE OF A SHEEP.

By Bernard Dyer, F.C.S.

Read before the Society of Public Analysts, on 14th April, 1880.

On two occasions—once two or three years ago, and once recently—I have been consulted with reference to fibrous masses found, during *post-mortem* examinations, in sheep that had died from obstruction of the bowels. In each case an accusation was made against the vendors of oil-cake on which the sheep had been fed, to the effect that the cake must have been the cause of the mischief—the cake being cotton-cake, and the supposition on the part of the owners of the sheep being that the cake must have contained sufficient cotton-fibre adhering to the crushed kernels to have caused the fatal accumulation. On microscopic examination, however, of the substance, I found that the fibre—which was brown, and coated of course with fœcal matter—contained no cotton-fibre, but consisted mainly of wool, the probability being that the sheep had been nibbling their fleeces in the endeavour to allay cutaneous irritation.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE EFFECT OF LIGHT UPON REAGENTS.

To the Editor of "The Analyst."

Sir,—In connection with my friend Mr. Blunt's paper on this subject, reported in the April number of The Analyst, it may be of interest to state that the oxidation of oxalic acid solution in sunlight may, under favourable conditions, be much more rapid than would appear from our experiment there quoted. For example, I have for some time past been endeavouring to turn this reaction to practical account as a means of measuring the oxidising power of sunlight from week to week; and, in the week ending April 22nd, I found that 4 c.c. of decinormal oxalic solution were entirely oxidised in sunlight. An important condition determining the rate of oxidation is the surface-area of the solution exposed. The tube in which the 4 c.c. referred to were contained was more than an inch in diameter. The same quantity in tubes of ¼-inch diameter had, during the same time, taken up only ·001 gramme of oxygen.

Faithfully yours, ARTHUR DOWNES, M.D.

REVIEW.

The Art of Perfumery.

By G. W. Septimus Piesse, Ph.D., F.C.S. London: Longmans, Green & Co.

This is the fourth edition of Dr. Piesse's Book, a fact in itself giving high testimony to its excellence. The author has taken care to deal with his subject in a full and comprehensive manner. Even snuff which " we repudiate " is considered in its proper place and under the same class as smelling salts, because its odour is mainly due to the liberation of ammonia.

The collection of formulæ in this volume is very extensive, and it will prove of much service as a book of reference to any analyst who is consulted on such matters.

The appendix on preparing artificial fruit essences contains more plain and useful information on the subject than we have seen collected in any other book. The volume is singularly free from printers' errors.

ANALYSTS' REPORTS.

Mr. J. Carter-Bell, Analyst to the Borough of Salford, in his report, states that during the quarter ended March 31st, 1880, he had analysed 138 samples. Of these, 43 were adulterated, namely, 38 milks, 1 unfermented wine, 1 oatcake, 1 whisky, and 2 beers. The sample of unfermented wine contained a considerable amount of copper, which might be seriously detrimental to health, for in warm weather a person might feel inclined to drink a large quantity of this acid sugary compound, containing a very dangerous dose of a copper salt. The presence of copper in the liquid is a proof of the careless and ignorant manner by which it had been prepared. There is little doubt that the mixture of tartaric acid and sugar has been boiled in copper vessels, and the acid has dissolved the metal. The quality of the milk supply this quarter has been much below the average. Some of the samples contained more than 30 per cent. of water. Several samples of beer have been analysed to ascertain the amount of salt, but only in two cases did the salt exceed 50 grains to the gallon. One of the samples of oatcake was adulterated with a large amount of chalk.

Mr. J. Carter-Bell, Public Analyst for the County of Chester, in his report, states that during the quarter ended March 31st, 1880, he had examined 288 samples. Of these 71 were adulterated—viz., 32 milks, six whiskies, six rums, six gins, one cocoa, six mustards, 13 coffees, and one butter. The report adds that it is remarkable how the quality of the milk varies in different divisions of the county; for instance, from the Hyde division 31 samples of milk were received, and 19 of them were adulterated, or 61 per cent.; whereas from the Eddisbury division, out of 20 samples only two were adulterated, or 10 per cent.; Nantwich, four samples of milk, and one adulterated; Altrincham, six samples, three adulterated; Wirral, eight samples, four adulterated; Stockport, 15 samples, three adulterated; Macclesfield, three samples, but all pure. In the Hyde division, where there is a large factory population, it is more than necessary that the milk should be pure, and of better quality than is to be found elsewhere.

LAW REPORTS.

Inspectors cannot take Samples from Milk sent by train before delivery to Consignee, and without authority from him. Railway Porter not Contractor's Agent to receive portion of sample :—

At Marylebone, Mrs. Thame, having a farm at Swanburne, near Bletchley, was summoned before Mr. De Rutzen for selling milk which had been diluted by water. Mr. Ricketts, solicitor, prosecuted on behalf of the Vestry of St. Pancras. The defendant was in the habit of consigning milk by the London and North Western Railway to a dairyman named Sims at Kentish Town. On the 18th ult., on the arrival of a churn of milk sent by the defendant to Euston, a sample of it was taken by William Roach, one of the sanitary inspectors of the parish, which on analysis was found to contain 11 per cent. of added water. John Hall, farmer, of Pinley, Coventry, Warwickshire, was summoned for a similar offence. The defendant in this case also sent milk to Mr. Sims. A sample of some that arrived at Euston on the 18th ult. was submitted for analysis and was found to have 10 per cent. of added water in it. The inspector had not been authorized to take samples of the milk by Mr. Sims in either case, but had done so as several complaints had been made to the Vestry. Mr. De Rutzen observed that he thought there was great objection to this mode of procedure, and he saw several difficulties that would arise from it. He did not think that the Act of Parliament contemplated such a thing. The milk had left the hands of the seller and had not arrived in those of the purchaser, and the inspector goes behind Mr. Sims's back to the station and lays violent hands on the milk and takes a sample from it. Where was the prejudice to the purchaser? Mr. Ricketts said that the power was given to the inspector, under the new Statute of 1879, to make seizure at the place of delivery. Mr. De Rutzen said that it was admitted the contract was to supply milk and that it was mixed with water. The only question was whether the proper proceedings had been taken to secure a conviction under the Act of last year, which amended the Sale of Food Act of 1875. By Section 14 of the latter Act it was enacted that the person purchasing with the intention of analysis after the purchase was completed should forthwith notify to the seller or his agent selling the article his intention, and should offer to divide the article sold into three parts, giving one of the parts to the seller or his agent. In these cases the samples were procured at the railway station, in the course of the milk being delivered to the purchaser, and one part was given to the porter at the station who was in charge of the milk, treating him as the agent of the seller. Although the porter might have been a person intrusted by the seller for the time being with the charge of such milk so as to render him liable to a penalty under Section 4 if he refused to allow the inspector to take a sample, in his opinion the porter was in no sense contemplated by the Act the agent of the seller to receive the sample. The inspector, therefore, having failed to comply with the provisions of the Act, the summonses must be dismissed. Mr. Ricketts asked for a case for the decision of a Superior Court to be given on the question. Mr. De Rutzen said that he would grant one. The Vestry, he thought, had taken a right course in endeavouring to defend the retail dealers of London, and they had only broken down in the way they had sought to carry it out.

Spirits may be Reduced below Strength fixed by Law if Notice thereof be given:—

Thomas Henry Cooke, grocer, of 94, High Street, Camden Town, was summoned for selling a bottle of Irish whisky which was adulterated by water so as to reduce the spirit more than 25 degrees under proof—namely, 31½ degrees under proof. Mr. Ricketts prosecuted for the St. Pancras Vestry; Mr. Townshend, from the office of Messrs. Linklater & Co., defended. Mr. De Rutzen said that he had already decided a case which was on all fours with this one in favour of the defendant. The Vestry of St. Pancras, however, thought it desirable in the interests of the public, and in consequence of some decisions supposed to be contrary to his, to raise the question again. Many people were under the impression that spirits could not be sold below a certain strength, and that idea had arisen, no doubt, owing to the marginal note of the 6th section of the Act passed last year, which says, "Reduction allowed to the extent of 25 degrees under proof for brandy, whisky, or rum, and 35 degrees for gin," and from that people had inferred that it could not be reduced to a greater extent. By that section the Legislature had merely fixed for the purposes of this Act a certain standard for the strength of spirits, and had enacted that it should be a good defence to a charge of adulterating spirits if it was proved that such admixture had not reduced the spirits to a greater extent than that which had been quoted. There was nothing in the Act to prevent people from selling spirits mixed with any greater quantity of water if at the time of sale and delivery they supplied to the person receiving the same a notice by a label that the same was so mixed, and if the magistrate was of opinion that it was not intended fraudulently to increase its bulk. There was a label on the bottle correctly describing, or rather understating, the strength of the spirit, from which he inferred that there was no intention of concealing the quality of the whisky. He was therefore of opinion that no offence had been committed, and the summons must be dismissed.

A Magistrate in a New Position:—

Robert Wilson, dairyman, Acton, was summoned at the Hammersmith Police Court for selling to James Gregg, inspector, milk which was not of the quality demanded. A certificate from Professor Redwood, the Public Analyst, stated that the sample contained milk which had been adulterated by the removal of part of the cream and the addition of 8 per cent. of water. Professor Redwood stated the grounds on which he concluded that the cream had been removed; but Mr. Paget, the magistrate, said it was all guesswork, and dismissed the summons, but gave the inspector leave to withdraw it. The summons was withdrawn.—*Telegraph.*

A New Defence for Water in Milk:—

At Marylebone, William Webb, farmer, of Church Farm, Hurst, Twyford, Berkshire, was summoned by the Metropolitan Dairymen's Society, for selling milk diluted with water. Samples taken from two churns of the defendant's milk consigned to Mr. E. Tisdall, of Kensington, on their arrival at Paddington showed that there was 10 per cent. of added water in one of the samples. Mr. Ricketts prosecuted for the Society, and Mr. Parish, the Society's Inspector, gave the usual evidence. It was contended that if there was any water in the milk it had found its way there by leakage in the refrigerator by which the milk was cooled before it was sent away. Mr. de Rutzen imposed a fine of £5 and costs.

NOTES OF THE MONTH.

Our readers will remember that last month an unfortunate difference of opinion occurred at Portsmouth as to a sample of coffee. We have received the following copy of a letter which has been subsequently addressed to the Town Clerk of that borough, by an enterprising gentleman. The letter speaks for itself as a specimen of professional ethics as understood by the writer—

School of Science, * * * * * * * * *March 8th, 1880.*

Sir,—Seeing the report of the coffee adulteration case in the papers, I write to ask the favour of an intimation in the event of the resignation of your Public Analyst now or at a future time, as I should in that case wish to make an application for the appointment. It would be found that I have good qualifications. Apologizing for troubling you, I am, Sir, your obedient Servant,

* * ******** F.C.S.,
Analytical Chemist.

We are informed that Dr. Turner has no intention of resigning, considering, as he does, that he has a perfect explanation of the difference of opinion, without throwing any doubt either on his own analysis, or that of Somerset House; but, meantime, we are glad to give the writer of the above letter this notice in our columns of his good qualifications and excellent business habits, of taking time by the forelock. Perhaps some of our members may know of another appointment which would suit him.

The Vestry of St. Pancras has been following the lead of the Vestry of Lambeth, in attacking milk adulteration at its possible source, by taking samples of milk at the railway stations, but unfortunately without the precautions adopted by the latter authority, and consequently a difficulty has arisen, as will be seen from our law reports. The remedy for the apparent stoppage is very simple, if the Lambeth plan be followed: the Inspector obtains the co-operation of the consignee, who attends at the station, receives the milk, and formally requests the Inspector to take the sample. In this way, the Lambeth Authorities have obtained something like 40 samples of milk, six of which have proved to be either watered or skimmed, and the farmers duly punished, to the great gratification of the local milk dealers.

A dispute is going on in America, *re* Oleo-margarine, which Mr. John Michels, a well-known New York microscopist, declares to be very dangerous. He states that the heat used is not sufficient to kill the embryos of living parasites, which are thereby transferred to the body of the consumer, and that this is rendered more likely to occur by the fact that, the refuse fat of at least one pork packing establishment in New York is worked up daily into "butterine," and exported both to England direct, and also to Holland. It is made up in tubs and even in pats, and stamped like genuine butter. On the other hand, Dr. Mott declares it to be perfectly wholeseme, but it is to be noted that he is chemist to one of the large grease factories. We would suggest to our members the advisability of carefully examining every sample microscopically, to see if they can discover any encysted parasites, and thus put at rest what is certainly a most serious question of public health. Personally, we have never as yet met with any such appearances, and would welcome communications on the subject.

On the "butterine" question, an eminent trade firm writes as follows:—"That oleo-margarine as presented in the form of butter, is an adulteration, a counterfeit, is clearly established; that it is injurious to health, we think can be scientifically proven; that it is working ruin to one of the most important industries of the country, is beyond question." It is somewhat unfortunate in the face of such opinions even from traders, that the low standard adopted for butter at Somerset House practically prevents the prosecution of any mixture less than about 40 per cent.—one of the specialists in butter having been stopped at 35 per cent.—and in one memorable case the pure "butterine" itself was passed over; but that is not likely to occur again, now that the authorities there have had time to perfect their experiments on the subject. Still the low standard remains so far as we can learn, and no analyst who values his reputation must venture to certify to anything under the percentage mentioned above. We trust, however, that the authorities will soon see their way to permit us to go down, to say, 25 per cent., which is really the ordinary amount added in practice to make up middling Dutch butter in the large factories, at Oos and elsewhere.

ANSWER TO CORRESPONDENT.—INQUIRER.—(1) Marsh's Test, which consists in the formation of arseniuretted hydrogen, is far the best test for the purpose. A small portion of the colouring matter should be detached from the paper, dissolved in hydrochloric acid previously proved to be free from arsenic, and this solution used to test with. If the colouring matter consists, as it most frequently does, of arsenite of copper, it will probably become of a deep blue colour when moistened with strong solution of ammonia. This test is not infallible, because the blue colour is sometimes masked by other colouring matters present.

(2) It certainly is probable that the quantities found in wall paper will prove injurious to health, and many well authenticated instances are on record.

Mr. James Baynes, jun., has been appointed Public Analyst for York, in the room of Dr. Proctor, deceased.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
3060	A. Budenberg	Pyrometers or Thermometers	6d.
3183	W. Cleland	Manufacture of Gas	6d.
3230	A. L. Bruce and W. McCowan	Treatment of Dextrine Maltose	8d.
3355	W. Morgan Brown	Manufacture of Electrodes for the Electric Light	6d.
3393	P. S. Justice	Telephones	6d.
3437	A. H. Hassall and O. Hehner	Preparing Extracts from Tea, Coffee, &c.	2d.
3562	W. R. Lake	Manufacture of Hydrogen Gas	6d.
3579	G. W. Bremner	Treating Phosphates of Alumina to obtain a Gum	4d.
3587	F. J. Cheesbrough	Electric Lamps	6d.
3645	W. C. Barney	Electric Telegraphs	6d.
3661	G. J. Lacombe	Manufacture or Treatment of Potash	2d.
3724	J. P. Rickman and J. B. Thompson	Manufacture of Ammonia and its Compounds	2d.
5149	J. Imray	Telephones	6d.
3844	J. Imray	Manufacture of Hydrocyanic Acid	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts *Journal; Sewage Disposal*, by Robinson; Potable Water, by Ekin; Nature's Hygiene, by Kingzett.

THE ANALYST.
JUNE, 1880.

THE ESTIMATION OF PHOSPHORIC ACID.

By Alfred Smetham, F.C.S., &c.

Read before the Society of Public Analysts, on 17th March, 1880.[*]

The experiments which I propose to bring before your notice this evening resulted from a statement made by Messrs. Teschemacher and Smith, in a pamphlet which they issued during the past year on the Estimation of Phosphoric Acid, wherein they gave in detail the process which they at present use in their laboratory, and also an account of some experiments which they had conducted on the solubility of ammonio-magnesic phosphate in ammonia water. By these experiments they came to the conclusion, which had previously been arrived at by other chemists, that this salt is totally insoluble in water containing ⅛th of its bulk of ·880 ammonia. In striking contrast with this conclusion is the high solubility which was found by Fresenius; which, however, I believe he has since found occasion to modify. As the conclusion of Teschemacher and Smith seemed to me at variance with what we should expect, and as, moreover, their experiments were conducted in a very crude manner, viz., by dissolving and reprecipitating ammonio-magnesic phosphate a great number of times, whereby they found that the resulting magnesic pyrophosphate weighed more than the precipitate obtained in the usual course from the same quantity of phosphate, I started the following set of experiments in the hope of setting the matter at rest.

A solution of phosphate was prepared by dissolving 50 grammes of pure phosphate of soda in a litre of water, which solution was used throughout the experiments.

Experiment I.—40 c.c. phosphate solution were mixed with 95 c.c. water, 40 c.c. of ·880 ammonia were added, and the phosphoric acid precipitated with 25 c.c. magnesia mixture, which allowed a good excess of magnesia. The solution was allowed to stand for 66 hours in a covered beaker in the laboratory when the resulting precipitate was filtered through a close Swedish filter, washed clean with ammonia water (1 in 4), dried, ignited and weighed. This yielded ·6385 grammes of $Mg_2P_2O_7$.

The filtrate was evaporated to a small bulk in a water-bath, and the phosphoric acid contained in solution determined by precipitation with ammonia, care being taken to ascertain the purity of the precipitate. On ignition it yielded $Mg_2P_2O_7$ ·0020 grammes.

The yield of pyrophosphate is ·0064 grammes in excess of the theoretical quantity, due probably to the fact that the phosphate had effloresced. This, however, is immaterial.

Experiment II. was conducted in a precisely similar manner, but with the following quantities.

40 c.c.	phosphate solution.
25 c.c.	magnesia mixture.
114 c.c.	·880 ammonia.
321 c.c.	water.
500 c.c.	

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[*] We regret that the publication of this interesting Paper should have been postponed so long.

This yielded a precipitate of $Mg_2P_2O_7$ weighing ·6350 grammes.

The filtrate on evaporation gave $Mg_2P_2O_7$ ·0060 grammes.

Experiment III.—In this experiment the quantities taken were:—

40 c.c. phosphate solution.
25 c.c. magnesia mixture.
120 c.c. ·880 ammonia.
815 c.c. water.

1000 c.c.

The pyrophosphate obtained from the experiment was ·6250 grammes. And on evaporating the filtrate a further quantity weighing ·0160 grammes was obtained.

From these experiments it is evident that ammonio-magnesic phosphate is perceptibly soluble in ammonia water, but not to the extent originally stated by Fresenius. Instead of an addition of one millegramme of pyrophosphate for every 54 c.c. of solution it would be necessary to add only one millegramme for every 100 c.c. by the first experiment, and by the second one millegramme for every 84 c.c. for ammonia water 1 in 4, and by the third experiment 1 millegramme for every 62 c.c. of 1 in 8 ammonia water. It is possible that the excess of magnesium may have slightly diminished the solubility, but as in practice the excess is always present, this is, as far as the present experiments are concerned, immaterial.

But even supposing that the solubility of ammonio-magnesic phosphate in ammonia water was *nil*, it by no means follows that the other substances which are present during the precipitation in the ordinary course by the citric acid process do not increase the solubility and, therefore, Teschemacher and Smith's statement that no allowance should be made for the solubility is far from conclusive. That this is so is proved by the following experiments.

Experiment IV.—To test the influence of citric acid the following quantities were taken and proceeded with as in Experiment I.

40 c.c. phosphate solution.
95 c.c. water.
40 c.c. ·880 ammonia.
25 c.c. magnesia mixture.
5 grammes of citric acid.

200 c.c.

This yielded a precipitate which, when converted into pyrophosphate, weighed ·6815 grammes.

The filtrate from this was evaporated in a platinum dish, ignited, dissolved in HCl, the P_2O_5 precipitated by addition of ammonia in a small bulk. This yielded ·0065 grammes $Mg_2P_2O_7$.

Experiment V.—This was conducted to ascertain the effect of iron in the presence of citric acid in preventing precipitation. The quantities of solution were the same as in Experiment I., but ·35 grammes of ferrous sulphate and 2 grammes citric acid were dissolved in the water previous to precipitation.

The precipitate formed was separated by filtration as before, and the filtrate evaporated, ignited, and the phosphoric acid determined by means of the molybdenum process.

This yielded $Mg_2P_2O_7$ ·0080.

Experiment VI.—The same quantities of the solutions were used in this case, but the ferrous sulphate was increased to ·7 grammes, and the citric acid to 5 grammes.

The filtrate was treated as in Experiment V., and yielded $Mg_2P_2O_7$ ·0065 grammes.

Experiment VII.—This, and the following two experiments were conducted to determine the effect of alumina on the solubility. ·5 grammes potash alum and 2 grammes citric acid were dissolved in 95 c.c. water, and the solution made up to the same strength as in Experiment I.

The direct precipitate weighed ·6425 grammes $Mg_2P_2O_7$. The filtrate was evaporated, ignited, fused with a little sodic carbonate and the phosphoric acid estimated with molybdenum.

This gave $Mg_2P_2O_7$ ·0055 grammes.

Experiment VIII.—A similar experiment to the last, but 1·5 grammes of alum and 5 grammes citric acid were used.

The direct precipitate weighed ·6340 grammes.

The filtrate treated as in Experiment VII. gave $Mg_2P_2O_7$ ·0095.

Experiment IX.—A similar experiment to VII. to VIII., but 5 grammes of alum and 5 grammes citric acid were used.

The direct precipitate weighed ·6300 grammes, and the filtrate yielded, when treated as before, ·0100 grammes.

From these experiments it is evident:—

I. That the presence of citric acid increases slightly the solubility.

II. The presence of iron makes no perceptible difference in this respect, the solubility being determined by the quantity of citric acid present.

III. Alumina increases slightly the solubility, but the quantity dissolved seems to be beyond a certain point determined by the citric acid rather than the alumina present.

IV. That the influence of alumina is not so marked as is generally supposed. The widespread idea that alumina prevents the precipitation is doubtless due to the fact that in the presence of much alumina the precipitate forms very slowly, but the almost complete separation is merely a matter of time.

By subtracting the solubility of ammonio-magnesic phosphate in ammonia water (1 in 4) from the increased solubility due to citric acid and alumina, and dividing by the quantity of citric acid in grammes, we arrive at the quantity of phosphoric acid expressed as $Mg_2P_2O_7$, held in solution by 1 gramme of citric acid.

In making the correction for solubility, I therefore propose to add ·001 grammes $Mg_2P_2O_7$ for every 100 c.c. of solution, and in addition to allow ·0015 for every gramme of citric acid used in the determination. This would, in a determination where 2 grammes of substance were taken, and the liquid amounted to 250 c.c., and where it was necessary to use 2 grammes of citric acid, amount to ·18 per cent. P_2O_5. The allowance is not great, but it is perceptible, and should in all cases be made.

I have had experience with the citric acid process for many years past, and as I have always found it give excellent results, I may, perhaps, be allowed to sketch the method which I pursue. About two grammes of the finely powdered substance are weighed accurately, transferred to a beaker and decomposed with HCl, and where necessary a drop or two of HNO_3. The solution is then evaporated to dryness in a water-bath, taken up with HCl, and after digestion, the insoluble silicious matter is separated by filtration; a weighed quantity of citric acid is added; the solution heated up nearly to boiling point, and a weighed quantity of oxalate of ammonia added. The quantities used must vary with the substance under examination, the knowledge only being acquired by experience, but it is seldom necessary to add more than two grammes citric acid or 2·5 grammes oxalate of ammonia. The free acid is then just neutralised, with dilute ammonia, and acetic acid added, to decidedly acid reaction. The liquid is kept simmering for a few minutes with constant stirring, and after standing a short time the oxalate of lime filtered. Great care must be observed not to have too large an excess of oxalate of ammonia present, as oxalate of magnesia in an ammoniacal solution is somewhat easily precipitated. To the filtrate ammonia of ·880 sp. gr. is added to about one-fourth of the bulk, and to the liquid, which must remain clear, or only slowly throw down a small precipitate, due to the magnesia present, magnesia mixture is added in moderate excess. The liquid must be set aside with occasional stirring for the precipitate to form—the time required being principally determined by the quantity of alumina present. It is best, however, to allow it to stand overnight, although in cases where the alumina is absent, or small, the precipitation will be found to be complete in two hours. The precipitate is then separated from the liquid by filtration, dissolved in as little HCl as possible, and reprecipitated with one-third of its bulk of ammonia. After allowing to stand for two hours with occasional stirring, it may be filtered, and after drying converted into $Mg_2P_2O_7$.

The oxalate of lime is converted to $CaCO_3$ by gentle ignition, weighed, dissolved in HCl, and tested for P_2O_5, which may be present in small quantities, and which should be determined.

From these data, and by correction for the slight solubility, the percentages may be calculated.

Warrington has made the statement that oxalate of lime is soluble to a perceptible extent in citrate of ammonia, and in order to ascertain the truth of this statement the following experiment was made: One gramme of pure $CaCO_3$ was dissolved in HCl, five grammes citric acid added, then two grammes oxalate of ammonia, the liquid (about 100 c.c.) just neutralised with dilute ammonia, and acidified with acetic acid. The precipitation was conducted in a hot solution, and after allowing to stand for a few minutes the liquid was filtered. The filtrate was evaporated in a platinum dish, ignited, the residue dissolved in HCl, and the lime precipitated as oxalate in a very small bulk. This yielded $CaCO_3$ ·0020 grammes.

It must be remembered that the citric acid used (five grammes) is far in excess of that required in an analysis, and supposing the solubility to be entirely due to the citric acid, we should have only ·0008 grammes of $CaCO_3$ dissolved where two grammes citric acid were used. This, with two grammes of substance taken, would only represent ·02 per cent. CaO, a quantity so small as to be insignificant, and certainly not exceeding the probable error where a large quantity of lime is present.

In accuracy, the process as described—when all precautions are taken—is unsurpassed by any, and gives strictly reliable results.

When the quantity of phosphoric acid present is small, and the iron and alumina large, the molybdenum process must be used; but with a large percentage of phosphoric acid, the citric acid process is all that can be desired.

Mr. Bernard Dyer said that the process described was one which he had used for several years past, and the results were thoroughly reliable. With regard to the time during which the precipitate stands, he might say that in the case of guanos or bone ashes where the proportion of iron and alumina was slight and the quantity of citric acid small, the precipitation was quite complete within one hour or one and a-half hours at the outside. Where much iron or alumina was present, it was certainly desirable to leave the precipitation for the first time standing overnight. He believed the errors which chemists fell into, and the impossibly high results too often obtained, were due to a great extent to the formation of oxalate of magnesia. He always re-dissolved the precipitate—the trouble was next to nothing, and it only extended the duration of the analysis by one and a-half hours. It was quite possible to make six phosphoric acid determinations in a day by that method.

Mr. Hehner said that the question of phosphoric acid determination was one at which he had worked a good deal, and in which he took much interest. He did not wish to insinuate that Mr. Smetham's and Mr. Dyer's results were incorrect, but if correct they were so only by a fortunate balance of the different errors of the method. Thus the great strength of the ammonia used for precipitating and washing (1 to 3 of strong ammonia) caused a loss by imperfect precipitation and solubility, whilst the proper strength was 1 of strong ammonia to 9 of water, or 1 of ammonia of Fresenius' strength (specific gravity 0·96) to 3 of water. It had long been shown (by Kissel) that any correction for solubility of the ammonium magnesium phosphate in such dilute ammonia ought not to be made, the precipitate being practically insoluble in the dilute ammonia; he thought the correction had been completely dropped. Another cause of error was that the magnesia mixture used by Mr. Smetham was sulphate of magnesia mixture. He thought that had been completely given up, and that it was well understood that from such sulphate mixture basic sulphates almost invariably entered into the phosphate precipitates. He did not see how Mr. Smetham's results went at all to show the solubility of the precipitate in dilute ammonia, as in all of Mr. Smetham's experiments magnesia mixture was invariably present, and it was known that in the presence of magnesia mixture the solubility was very different from that when dilute ammonia only was employed. He considered the molybdic method a far better one, and, after all, the easier and cheaper of the two, no re-dissolving and re-precipitating of precipitates and objectionable corrections for solubilities being required. It certainly allowed of the employment of small quantities of manure only, but if the work was done with due regard to all circumstances there was no chance of error. Most of Mr. Smetham's results were too high, and he attributed this to the presence of sulphate of magnesia in the precipitate and to over-correction.

Mr. Smetham, in reply, said that he had many times worked the molybdate and citric acid processes together on samples of mineral phosphate, and only once had they differed more than 0·2 per cent.; in the majority of cases the difference being within ·05 per cent. In the only case in which they differed he found on repeating that the molybdate process was at fault. He differed entirely from Mr. Hehner as to the solubility. Many experiments had proved that where the quantity of ammonia was lessened, the solubility became greater. He took particular care to prove the purity of the precipitate; he thought it might safely be considered as having been due to the solubility only; the magnesia mixture he used was made with sulphate, but in his ordinary work he always tested the precipitates, and found that they were quite pure, and that was more than could always be said of the molybdate process, by which, when the precipitates were tested, there was a trace of iron carried down. There was more danger of oxalate of magnesia being precipitated than of the basic sulphate, and it was for that reason he put special stress on the necessity of weighing the oxalate of ammonia used. With due care his process gave quite as accurate results as the molybdate process, since it was possible to work with four times the quantity of substance, and errors in weighing, &c., were therefore considerably diminished, and as it was also more expeditious and less expensive, it was to be preferred where many analyses had to be performed.

NOTE ON THE ANALYSIS OF SOME SAMPLES OF CHIAN TURPENTINE.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 2nd June, 1880.

Chian turpentine has for many years past been almost unknown in this country, and its use in pharmacy had almost entirely ceased, but special interest has been directed to it of late by the statement of the success with which Professor Clay has been using it in the treatment of cases of cancer. Great difficulty was experienced in obtaining even a small supply of the genuine article, and Professor Clay stated that more than 95 per cent. of the samples which he had seen were spurious. I have examined some samples of undoubted genuineness in order to obtain a standard for future comparison.

The description given in Flückiger and Hanbury's *Pharmacographia* is as follows:—"A soft solid becoming brittle by exposure to the air; viewed in mass it appears opaque, and of a dull brown hue. If pressed, while warm, between two slips of glass, it is seen to be transparent, of a yellowish brown, and much contaminated by various impurities in a state of fine division. It has an agreeable, mild terebinthinous odour and very little taste."

As to its chemical composition, *Pharmacographia* says—that it consists of resin and essential oil; the former, *i.e.* the resin, being probably identical with the alpha resin of mastich.

The first sample which I examined (obtained from Messrs. Allen & Hanburys) was very probably a portion of the sample referred to in *Pharmacographia*, and would, in all probability, be 10 or 15 years old. It was of an opaque yellow brown colour, rather too soft to make a good pill mass alone, very slightly sticky, and covered on the surface with a whitish powder, which appeared to consist of parts of the resin itself, acted on by the atmosphere. A small portion was melted and dropped into cold water so as to form tears, and the sp. gr. of these tears was found to be 1050 at 60° F. If one of these fragments is gradually heated in water to the boiling point, it melts and expands rapidly, becoming lighter than the water, and floating as a film on the surface.

With the exception of a small amount of mineral impurities, consisting chiefly of sand, it dissolves readily in boiling alcohol 60 o.p., which becomes slightly milky when cold. The resin is precipitated as a white powder on dilution with water.

Absolute alcohol dissolves it readily even in the cold; so also do ether, chloroform and bisulphide of carbon. Petroleum spirit and turpentine dissolve it readily on warming, and wood naptha dissolves it slowly on warming, the solution becoming slightly milky on cooling.

A portion was distilled with water for the volatile oil, which was found to amount to a little over 9 per cent.

A 20 per cent. solution of the turpentine itself was examined in the polariscope, and gave a right-handed rotation of 9° 12′ in a tube 200 m.m. long for the sodium ray.

The essential oil from the same solution gave a rotation of 1° 54′ for the sodium ray, leaving 7° 18′ as the rotation due to the resinous constituents.

The sample contained two different resins, one of which saponifies readily with carbonate of soda, and the other saponifies with somewhat more difficulty, but forms a far-less soluble soap. This latter is present in by far the larger quantity, and it appears likely from its appearance and character that it corresponds pretty closely with the alpha resin of mastich.

Dividing these resins as far as possible by solubility, the sample appeared to contain as follows:—

Volatile Oil	9·2	per cent.
Alpha Resin	79·0	,,
Gamma Resin	4·0	,,
Benzoic Acid	traces	
Impurities, chiefly sand	7·3	,,
	99·5	,,

The second sample I examined was a portion of a new supply just received in this country, but coming through almost the same channel as the first one. It was, of course, newer, and probably from that cause somewhat softer; the brittle characteristic of the original sample was, however, strongly marked, and the tears, which had been produced by letting a few drops fall into the water, were sufficiently brittle to break when allowed to fall on to the table.

A 20 per cent. solution, examined in the polariscope with a sodium flame gave a rotation of 7° 46′, of which 1° 54′ was due to the volatile oil, and the difference 5° 52′ to the resin. Apparently, therefore, there was some slight difference in the optical rotatory power of the resin in this sample.

Saponified and treated in the same way, it gave the following results:—

Volatile Oil	9·2	per cent.
Alpha Resin	81.0	,,
Gamma Resin	6·0	,,
Benzoic Acid	traces	
Impurities—ash	1·4	,,
Woody fibre	2·0	,,
	99·6	,,

The sp. gr. of this sample was 1052, or rather higher than the old one.

A third sample of very similar appearance was procured in London from another source. This was probably old, although perhaps not so old as the first sample above referred to.

The sp. gr. was 1043. The rotation in the polariscope was practically identical with the first sample. The analysis showed, however, a larger percentage of volatile oil, viz., 12·1 per cent., and it contained a mere trace of ash and a smaller proportion of impurities. This, which was to all appearance a genuine sample, was evidently more carefully collected.

A fourth sample, also purchased from a London wholesale house, was obviously a spurious one, and I record its characteristics here simply to enable such samples to be distinguished. In colour, appearance and smell it closely resembled Canada balsam; it was softer and far more tenacious than genuine Chian Turpentine, so sticky, in fact, that it was with difficulty it could be removed from the fingers. When a portion was rubbed on the hand the smell was extremely pungent and persistent. The sp. gr. was 1000 or exactly identical with water at 60° F. In connection with this, it should be borne in mind that the sp. gr. of Canada balsam is less than water, some samples being as low as 970. Its rotatory power in the polariscope was 6°·15′ for a 20 per cent. solution in a tube 200 m.m. long; that is, it was only about two-thirds of the rotation of the genuine samples. It yielded about 26 per cent. of volatile oil, or more than twice that contained in the genuine samples, and the rotation due to the volatile oil was 3° 36′, leaving only 2° 39′ due to the rotation of the resin, or less than half that of the genuine samples. The solubility in alcohol, ether, chloroform, petroleum spirit, naphtha, bisulphide of carbon, and turpentine showed no difference from the genuine samples which was capable of being used for discrimination. It appeared to contain about 70 per cent. of a resin which corresponded in some respects to the alpha resin found in the genuine samples, but was of a darker colour, and formed a much harder and more brittle soap, while I could not detect the slightest trace of benzoic acid. My opinion is that this sample was mainly a mixture of Colophony and Canada balsam.

It appears most probable that the Chian turpentine, described as Cyprian or Syrian, or Chio, in *Watts' Dictionary*, p. 920, was a sample of this kind, for the description there states, among other things, that it was viscid, and had an aromatic taste like that of mastich, both of which statements correspond exactly with this spurious sample, but are incorrect as regards the genuine samples first referred to.

NOTES ON CREAM OF TARTAR.

By Alfred H. Allen.

Read before the Society of Public Analysts, on 14th April, 1880.

Crude tartar or argol is well-known to be a crystalline crust deposited during the fermentation of grape juice. It consists largely of acid potassium tartrate, but if plaster be used in the manufacture of the wine, the tartar contains a large proportion of calcium tartrate.

Cream of tartar is generally admitted to be a preparation obtained by boiling crude tartar or argol with water, filtering, and crystallising the salt from the clear liquid. The term "cream" of tartar is derived from the fact that during the evaporation of the liquid the salt is deposited in white crystalline crusts on the surface of the solution.

Cream of tartar thus obtained consists chiefly of potassium hydrogen tartrate, $KHC_4H_4O_6$. All commercial samples contain more or less tartrate of calcium, which, though nearly insoluble in pure water, dissolves with moderate facility in a hot solution of acid tartrate of potassium.

According to the *British Pharmacopœia*, cream of tartar is a synonym for the acid tartrate of potash, but the solution in hydrochloric acid is admitted to be "rendered slightly *turbid by* oxalic acid" after neutralization by ammonia.

According to Pereira, cream of tartar "contains from two to five per cent." of calcium tartrate. All the specimens which Thomson examined contained "rather more than five per cent." Stillé and Maisch say, "The amount of tartrate of calcium contained in *crude* tartar varies between 5 and 15 per cent."

According to R. Warington—a high authority on this subject—the proportion of tartaric acid existing as neutral tartrates in refined tartars varies from one and a-half to seven per cent. Taking these amounts as calcium tartrate, we may say that the proportion of that salt existing in cream of tartar is, according to Warington, from 2·0 to 8·8 per cent.

In my capacity of Public Analyst, I have recently received from inspectors 14 samples of cream of tartar which have been considered genuine. These were obtained at various small towns and villages in Derbyshire and the West Riding of Yorkshire, and their purchase extended over some ten months. As one of the tests of purity, I am in the habit of igniting a known weight of the sample, boiling the residue with water, filtering, and again igniting the residue. This last product, when moistened with carbonate of ammonium, consists essentially of calcium carbonate. If the original cream of tartar was pure, it should dissolve completely in hydrochloric acid, or leave merely a faint trace of residue. Evidently its weight represents the calcium in the original sample, and if the amount be multiplied by the factor, 1·88, we obtain a very fair estimate of the proportion of calcium tartrate originally existing in the sample. In the fourteen samples referred to, the highest percentage of "insoluble ash" (= $CaCO_3$) found was 6·46 per cent., the next being 6·36, and no other above 4·68. The lowest amount was 2·60, and the mean of the whole fourteen was exactly four per cent. Multiplying these numbers by 1·88 we find that the highest amount of tartrate of lime met with was 12·14 per cent., the lowest 4·89 per cent., and the average 7·52 per cent. In the case of the two samples yielding 6·46 and 6·36 per cent., of insoluble ash, I ascertained the amount of matter left on boiling the original sample with water, and found 3·15 and 3·35 per cent. respectively. These residues, insoluble in water, were soluble in hydrochloric acid, and, as far as my notes go, appear to have consisted of calcium tartrate. Hence, if 3·15 be substracted from 12·14 per cent., we have a remanet of nine per cent. legitimately present as a soluble constituent of the cream of tartar.

The following table shows the proportions of calcium tartrate present in cream of tartar, according to different observers :—

	Neutral Calcium Tartrate. = $CaC_4H_4O_6$.
Pereira	2 to 5 per cent.
Thomson	5 to 6 ,,
Warington	2 to 8·8 ,,
Vauquelin	5 to 7 ,,
Paul	1 to 10 or 12 per cent.
Allen	4·9 to 9 per cent.

In contradistinction to the above results, on September 24th, 1879, at Chertsey Petty Sessions, Mr. William Hodgkinson, of Aldersgate Street, when under examination as a witness for the defence of a druggist who had been prosecuted for selling cream of tartar obtained from Messrs. Hodgkinson & Co., is reported to have stated that—

1. "Cream of tartar was sent to this country from Spain and France, and came in a state that was known as argol."

2. "The article sent to Mr. Boyce (the defendant) was the very finest that could be obtained."[*]

3. "Argol, or cream of tartar, was the natural product of the fermentation of the juice of the grape."

4. "It was impossible to have cream of tartar without tartrate of lime, and he was informed from the best authority that it was generally found in quantities from 10 to 20 per cent., and the lowest he had ever heard of was 7 per cent."[*]

5. "He could not account for the very small amount of baryta being with the drug, but had seen it with cream of tartar before."

In the course of a correspondence in the *Pharmaceutical Journal,* which arose out of the above evidence, Dr. Redwood wrote:—"The cream of tartar alluded to by Mr. Hodgkinson, was represented by the grinder as having been obtained by the delivery order for 'cream of tartar in its crude state,' which, of course, means the usual roughly crystallised cream of tartar, a very different thing from crude tartar or argol."

Here then we have a general consensus of opinion that cream of tartar contains a *maximum* amount of nine or ten per cent. of calcium tartrate, and is distinct from argol; while, on the other side, Mr. Hodgkinson stands alone with his evidence that cream of tartar and argol are identical, and that the former contains a very considerable proportion of calcium tartrate.

With a view of ascertaining by direct experiment how far calcium tartrate could exist normally in cream of tartar, I have instituted the following experiments:—

Pure calcium tartrate was prepared by precipitating calcium chloride by neutral sodium tartrate prepared from pure tartaric acid and carbonate of sodium. The analysis of the salt showed that it was strictly neutral in composition.

Pure potassium hydrogen tartrate was prepared by dividing a solution of pure tartaric acid into two equal portions, neutralising one with potassium carbonate, and adding the other.

Weighed quantities of the last product were dissolved in known measures of boiling water, an excess of moist tartrate of calcium added, the liquid boiled for a short time, filtered boiling hot, and the crystals of cream of tartar deposited on the cooling of the filtrate were analysed. In this manner, products were obtained which contained as much calcium tartrate as would dissolve in the measure of boiling solution of tartrate of potassium employed. The only variable condition was the proportion of water used.

It was not found practicable to dissolve the acid tartrate of potassium in fifteen times its weight of boiling water. Hence 1 in 25 was the strongest solution employed. The following are the percentages of insoluble ash and anhydrous neutral tartrate of calcium contained in the different products:—

	Proportion of water used.	Insoluble Ash × 1·88 =	$CaC_4H_4O_6$.
1.	25 parts	3·10 per cent.	5·82 per cent.
1A.	25 ,,	3·28 ,,	6·16 ,,
2.	50 ,,	3·40 ,,	6·39 ,,
2A.	50 ,,	3·30 ,,	6·20 ,,
3.	75 ,,	4.40 ,,	8.27 ,,
3A.	75 ,,	4.80 ,,	9.02 ,,

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[*] Notwithstanding Mr. Hodgkinson's evidence, it is satisfactory to know that before the above case (selling cream of tartar containing 11·7 per cent. of tartrate of lime, and 0·6 per cent. of $BaSO_4$) was heard, his firm supplied to a Sheffield pharmacist a highly satisfactory article, containing barely *seven per cent. of tartrate of* calcium, and no trace of barium sulphate.

From these results, obtained in my laboratory by Mr. W. F. Cocker, it appears that the proportion of calcium tartrate contained in cream of tartar is greater the larger the proportion of water used for solution. The proportions of calcium tartrate are not always strictly constant even under apparently similar conditions. An additional experiment was made by evaporating, at a boiling temperature, a solution in 50 parts of water, and skimming off the crystals from the surface as fast as they formed. The product so obtained contained 6·8 per cent. of calcium tartrate.

The above experiments clearly show that, with such a proportion of water as is likely to be used in practice, the product will not contain more than nine or ten per cent. of calcium tartrate, and this conclusion is fully confirmed by the general experience as to the composition of cream of tartar. One or two per cent. in excess of ten may be allowed as a margin, but it may be safely concluded that any sensibly greater proportion of calcium tartrate is not a normal constituent of the sample.

The higher amounts of calcium tartrate occasionally found in cream of tartar are, doubtless, due to adulteration by compounds of calcium. Sophistication by chloride of calcium is said to have occurred, and there are authentic cases of adulteration by chalk and marble. In a cream of tartar sold near Pontefract, I recently found 20 per cent. of sulphate of calcium* (anhydrous), probably added as plaster of Paris, and in a recent instance in America, as much as 75 per cent. of *terra alba* is reported to have been present.

I believe that in many cases in which a high percentage of calcium tartrate has been found, sulphates were also present, and hence the calcium tartrate did not exist wholly in that form in the sample, but was the result of a double decomposition on treating the cream of tartar with water.

In the sample in which I found 20 per cent. of calcium sulphate, there was also 2·3 per cent. of sulphate of barium. In a case at Huddersfield, Mr. Jarmain found the same impurity in the form of crystalline heavy-spar, and in many other cases small proportions of barium sulphate have been met with. Dr. Redwood suggests that the sulphate of barium may arise from the *yeso*, or Spanish earth, used for plastering wine. He appears to ignore the fact that barium sulphate is an insoluble body. Other apologists for its presence have suggested that it has its origin in the stones employed for grinding the drug. On this point I feel I cannot do better than quote an editorial which appeared in the *Pharmaceutical Journal* for November 22nd, 1879 :—

"The weight of cream of tartar ground by one pair of stones will sometimes amount to 15 or 20 tons in a month, and if only one per cent. of sulphate of baryta was introduced into the powder by the abrasion of the stones, they would very soon cease to exist as stones, since they do not weigh more than five or six hundredweight each.† On the contrary, the fact is, that these stones wear down very little, and last a very long time. But there is another point of evidence especially conclusive as to the origin of the sulphate of baryta in cream of tartar, and this is the fact that by shaking a cask of cream of tartar crystals in such a manner as to make all the dust settle down to the bottom, almost all the sulphate of baryta will be found in this dust; in one instance that lately came within our knowledge

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* This was calculated from the sulphates. The calcium was considerably in excess of that corresponding to the above amount of calcium sulphate.

† And how much silica would the cream of tartar contain ?

the amount was no less than 45 per cent. There is, therefore, reason to believe that the adulteration of cream of tartar with heavy spar is systematically practised, and that it is probably carried out by throwing a handful of the coarse powder here and there into the casks while they are being packed." A very probable origin of the sulphate of barium in ground cream of tartar is the objectionable trade practice of requiring the grinder to return ground material of the full weight of the article sent to him for reduction, thus compelling him to make up the inevitable loss of weight in some way.

LAWS OF WISCONSIN.

The following is an Act passed by the State of Wisconsin.

AN ACT to prevent the adulteration of food and medicine, and provide for analysing the same. The people of the State of Wisconsin, represented in senate and assembly, do enact as follows :—

Section 1. The governor of the state shall appoint one of the professors of the state university of sufficient competence, knowledge, skill and experience, as state analyst, whose duty it shall be to analyse all articles of food or drink, and all drugs and liquors manufactured, sold or used within this state, when submitted to him as hereinafter provided. The term of office of such analyst shall be three years from his appointment, unless sooner removed by the appointing power, and his compensation shall not exceed two hundred dollars in addition to his annual salary as professor, and shall be paid by the board of regents of the state university, from the university fund.

Section 2. The state board of health and vital statistics, medical officers of health, inspectors of weights and measures, boards of supervisors of any town, boards of trustees of any village, alderman or common council of any city in this state, or a majority of said corporate bodies, may, at the cost of their respective corporations, purchase a sample of any food, drugs or liquors offered for sale in any town, village or city in this state, in violation of sections numbers one, two and four of chapter two hundred and forty-eight of laws of A. D. 1879, or if they have good reasons to suspect the same to have been sold or put up for sale contrary to the provisions of said chapter two hundred and forty-eight, may submit the same to the state analyst as hereinafter provided, and the said analyst shall, upon receiving such article duly submitted to him, forthwith analyse the same, and give a certified certificate to such person or officers submitting the same, wherein he shall fully specify the result of the analysis.

Section 3. Any person purchasing any article with the intention of submitting it to an analysis, shall, after the purchase shall have been made and completed, forthwith notify the seller or his agent selling the same, of his or their intention to have the same analysed by the state analyst, and shall offer to accompany the seller or his agent with the article purchased to the town, village or city clerk of the place in which the article was bought, and shall forthwith remove the article purchased to the office of said clerk, and in the presence of the seller or his agent, if present, divide said article into two parts, each to be marked, fastened and sealed up in such a manner as its nature will permit. The said clerk shall forthwith forward one part to the state analyst by mail, express or otherwise, as he shall elect, and shall retain the other part or package subject to the order of any court, in which proceedings shall thereafter be taken. The certificate of the state analyst shall be held in all the courts of this state as *prima facie* evidence of the properties of the article analysed by him.

Section 4. If any person applying to purchase any article of food, drug or liquor exposed for sale or on sale by retail on any premises in any town, village, or city in this state, and shall tender the price of the quantity which he shall want for the purpose of analysing, not being more than shall be reasonably required, and the person exposing the same for sale shall refuse to sell the same, such person so refusing to sell shall be liable to a penalty not exceeding fifty dollars.

Section 5. The state analyst shall report to the state board of health and vital statistics the number of all the articles analysed, and shall specify the results thereof to said board annually, with full statement of all the articles analysed and by whom submitted.

Section 6. The state board of health and vital statistics may submit to the state analyst any samples of food, drugs, or drink for analysis as hereinbefore provided.

Section 7. This act shall take effect and be in force from and after its passage and publication.

Approved March 15, 1880. (Published March 26, 1880.)

REVIEWS.

Sewage Disposal.

By Henry Robinson. Spon & Co., Charing Cross.

It is very uncommon to find an author write a book on Sewage Disposal without expressing some very pronounced opinons in favour of one system or another, but in this case our author appears to think that all systems may be used in certain cases, and says, "Where suitable land is available I advise irrigation, but where such is not the case I employ chemical treatment, either in aid of land where too little is obtainable, or as a substitute for it altogether where it cannot be obtained." The same impartiality is carried through the whole book, for the only instance in which the author shows any preference for one process rather than another, is where he says that on one occasion he held an interest in a patent for the use of proto-sulphate of iron in combination with sulphate of alumina, but that his interest has since been given up. The Rivers Pollution Commission Report, and most of the other publications on the sewage question have been freely drawn on for the information contained in the work, and the sources of the information acknowledged. There is but very little novel matter in the book, but, as a short and convenient compendium of what has been done, and entirely devoid of personal idiosyncrasies, it may fairly be recommended for all who want such a manual at hand.

Potable Water.—How to form a Judgment on the Suitability of Water for Drinking Purposes.

By C. Ekin. Churchills, New Burlington Street.

This little *brochure* of only 25 pages scarcely justifies its title. It is a collection of a fair number of tolerably well-known facts and statistics, combined with a general review of a part, but only a part, of the best processes used by leading analysts for the analysis of potable waters. Comparatively small reference is made to anything except organic matter, and in reference to this the figures quoted are mainly the results of Dr. Frankland's analyses, although the author evidently differs very greatly from Dr. F. in the deductions drawn, since he gives a separate table of some waters classed as unpolluted by the Rivers Pollution Commission, "whereas in reality they are polluted." The book does not give instructions for forming a judgment as to potable water, because it omits all reference to the results of the microscopical examination, and those physical tests which throw so great a light on the previous history of most waters. Still, as far as it goes, it will be a handy book of reference.

ANALYSTS' REPORTS.

Dr. Alfred Hill, Public Analyst for Birmingham, in his quarterly report states that he examined 43 samples during the first quarter of the year, comprising 26 milks, six beers, six teas, four flours, one butter; and that no fewer than 23, or 89 per cent., of the milks had been more or less adulterated, or deprived of some of their cream.

Dr. Hodges, Public Analyst for Belfast, reports that during the past quarter he examined 61 samples, and of these 12 milks were adulterated by the addition of water, and two samples of quinine wine contained merely traces of quinine. Eight parties were fined in the sum of £22 5s. for selling adulterated milk.

Mr. James Baynes has been appointed Public Analyst for the Borough of Beverley, *vice* Dr. Procter, deceased.

LAW REPORTS.

When Sample not divided by Inspector, the portion not used by Analyst should be sealed up in Inspector's presence ;—

At Belfast, David McGown, farmer, Ballygowan, was summoned for having sold adulterated buttermilk on the 20th February. Mr. M'Lean, who conducted the prosecution, said the Town Council were very much interested in cases of this kind, as a decision had been given the previous week in that court which was entirely at variance with the decisions given during the past six years. In fact, if the decision referred to stood good, there would be no use whatever in the sanitary officers buying milk and getting it analysed. So strongly did the Council feel on the point, that they intended to have the case tried in a superior court should a similar decision be now given. He then read the different sections of the Act bearing on the case. One of the sections provided that, at the time the milk was purchased, the purchaser should divide the milk into three parts if asked by the seller to do so. One of these parts was to be handed to the seller, another to the analyst, and the third to be kept by the sanitary officer. Should the seller require this not to be done, another section provided that the local analyst was to take one part of the sample for the purposes of analysis, and to seal the remainder up in order that it might be sent to Somerset House for analysis if required. Sanitary Officer Anderson deposed that he purchased a pint of buttermilk from the defendant on the 20th February last. He informed him for what purpose he wanted it, and asked him if he wished to keep part of it. The defendant replied that he did not. Witness then sealed the sample up in a bottle, and afterwards brought it to Dr. Hodges, who took out of the bottle what he required for analysis. He then sealed up the remainder in witness's presence, and handed it back to him when he gave the certificate. The certificate stated that the milk contained 51 per cent. of added water. Mr. O'Donnell (magistrate) said that when the decision was given on the previous occasion, he was not satisfied that the analyst had sealed up a portion of the sample for further analysis by the officers at Somerset House if required. Defendant was fined £5. Mr. M'Lean said the defendant was a poor man, who held six acres of land, and so heavy a penalty might ruin him. The Bench, however, declined to mitigate the penalty. Agnes Steed was summoned for a similar offence. Mr. M'Lean, sen., prosecuted, and Mr. Harper appeared for the defence. It was proved that the defendant had sold sweetmilk containing 31 per cent. of added water, and their Worships imposed a fine of £5. Mary Ann Jamison and James Hughes for similar offences, were each mulcted in a like amount.

Inspectors may Purchase Samples by Deputy.—Queen's Bench.—Judgment :—

The case of Horder *v.* Scott was heard in the Queen's Bench Division, before Justices Lush and Field, on the 4th May. It was an appeal from the decision of the justices in petty sessions at Bushbury, in the county of Staffordshire. The appellant was represented by Mr. Jelf, Q.C., and the respondent was not represented by counsel. Agnes Scott, the respondent, was charged before the magistrates upon a summons taken out by John George Horder, of Lichfield, inspector of weights and measures, and inspector under the Food and Drugs Act for one of the districts in South Staffordshire—that she, in the parish of Bushbury, did sell to one Samuel Toy, coffee that was not in nature, substance, and quality the article demanded by such purchaser. The magistrates dismissed the summons, and in the case stated by them for the opinion of the Queen's Bench they recited the facts to be the following:—Samuel Toy testifies that he is assistant to Mr. J. G. Horder, and on his behalf he went on December 27th last to the shop of the respondent about 10 a.m., and purchased two ounces of coffee. Mrs. Scott asked him if he wanted the best, and he said "Yes." She charged him 2½d. for the commodity. He thereupon told her that he had bought it for the purpose of having it analysed, and she then told him that it was a mixture of coffee and chicory. Mr. Horder was not present, but he delivered the article to him at Wolverhampton, and he had it analysed. The substantial question, said Mr. Jelf, was whether an inspector can act by a deputy; and there was also a question whether, on the information in the form in which it was laid, there could be a conviction. Mr. Justice Field: What do you mean by an assistant? Is it shown what the terms of his employment were? Mr. Jelf: No; we know nothing of that except that he was his assistant. Of course, I am to argue that the inspector may act by an assistant. Mr. Justice Field: You explain. We know what an inspector is, but we do not know what an assistant is. Is it anything more than—"I went by order of Horder to buy"? Mr. Jelf: If he did that, there would be an acting by deputy under this statute. That is a point of very great importance, because the Act in many districts would be unworkable, from the fact that an inspector cannot be everywhere. There is the question whether the form of the information ought to have been taken out by Toy himself, treating him as the purchaser; or whether, if the matter was taken up by the inspector, he ought not to have been named as the purchaser. Mr. Justice Field: If I send my servant to purchase a pound of sugar, do I purchase or my servant? Mr. Jelf: It may be considered as a purchase by either. I have some difficulty in being quite certain about that. Mr. Justice Field: Then a seller is liable to two people? Mr. Jelf: He would not be liable for two offences. Mr. Justice Field: Is that so? If I send half a dozen servants, is the seller answerable for each? Or the servant of ten people,—are all the ten people purchasers within the meaning of the Act? Mr. Jelf thought that the persons who are masters would be within the meaning. Mr. Justice Field: Relative to the seller the servant is the purchaser. Mr. Jelf contended that an official purchaser may act under the statute, by the provisions of Section 13. Section 12 provides that any purchaser of an article of food should be entitled on payment to a Public Analyst of 10s. 6d., or to any other analyst of such sum as may be agreed upon, to have the article purchased analysed, and a certificate of analysis given. Therefore any ordinary individual might put the Act in motion; and, by Section 13, the inspector comes upon the scene. It provides that any inspector "may procure" (he called the attention of their Lordships to this, as being larger than "buy" *or* "*purchase*") any sample of food or drugs, and if he suspect the same to have been sold to him contrary to any provision in the Act, he could submit it for analysis to the analyst of the district. Mr. Justice Lush at this point remarked: I do not think we need trouble you any further, Mr. Jelf. I am of opinion that the magistrates are mistaken in the conclusion to which they have arrived. This question turns upon Sections 13 and 14. Section 13 says any inspector may procure any sample of food and shall submit the same for analysis. Their Lordships conferred a moment, and Mr. Justice Lush stopped delivering judgment, observing: My brother calls my attention to the form of the summons. It is alleged to be a sale to the prejudice of Toy, the purchaser. Mr. Jelf: I said there were two questions, one of which was a question of fact. Mr. Justice Lush: If it had been alleged to be to the prejudice of the inspector I could not have had a moment's doubt. Mr. Jelf: I think I can satisfy your Lordships as to that. Mr. Justice Field: Then go on. Mr. Justice Lush: That is the only question in my mind; but is not that amendable? In order to settle this legal difficulty the further argument was adjourned. In the afternoon Mr. Jelf resumed the discussion, contending that, under Jarvis's Act, the duty of the magistrates with reference to the form of the information and summons is that they are not to allow a variation between the information and the evidence to affect the matter, unless they think that the parties will be in any way injured or prejudiced thereby, and that then they may grant an adjournment. Mr. Justice Lush interrupted the argument by asking when the case came on, and finding that it was at the close of last year he observed that it would come under the statute passed last year, and that that would get over the difficulty. He accordingly proceeded to give judgment. The magistrates were wrong, and the case must go down to them again. It was true that Toy was an agent of the inspector, and bought the coffee as an agent, and not for his own use, but for the purpose of analysis. Before the Act of last session there was a difference of opinion in this country and in Scotland about the meaning of that particular clause; but then the Act of last session took away all the difficulty arising from that construction. It provided that if any prosecutor under the provisions of the principal Act shall obtain any article of food, and have it analysed, it shall be no defence to such prosecution to allege that he having bought it only for analysis is not prejudiced. Toy might be considered therefore as an ordinary purchaser, as a man who went in and ordered the best coffee, and, it being supplied to him as best coffee, it turned out to be, one-half chicory. On the hearing it appeared that he had been sent by the inspector. He gave due notice to the seller. He delivered the coffee to the inspector, and the inspector sent it to the analyst, and the analyst reported upon it, and that was on the evidence in favour of the prosecution. The magistrates, however, considered that as the proceedings were initiated by the inspector in his official capacity, he having laid the information, and having regard to Sections 13, 14, and 17 of the Act, should personally have purchased the article. He thought they were entirely wrong in that. It did not signify whether the inspector purchased by his own hand or purchased by his agent. Then the magistrates held, secondly, that Samuel Toy, being the purchaser and not the inspector, should have submitted the article to the County Analyst. There, again, he thought the magistrates were wrong. He thought they mixed up the procedure under the Act with the substance of the offence itself. Section 13 of the Act says that any purchaser of an article of food may require or may have the services of an analyst to have the article analysed, and receive a certificate of the analysis. The next section says that any inspector who purchases is bound to take cognisance—it is a duty on his part; the ordinary purchaser may or may not, if he pleases; but that is only a mode of ascertaining the genuineness of the article. As between Toy and the seller, Toy was the purchaser. It would have been equally good to have described the inspector as the purchaser. Toy delivered the coffee over to the inspector, and he handed it to the analyst. That is what any person would have a right to do if he had no connexion with an inspector. If the thing was properly analysed, it does not signify through whose hands the article was bought. Therefore, when the magistrates held that Toy, being the purchaser, the information was bad because laid by the inspector, their decision was wrong. Then, thirdly, the magistrates said that the mode in which the article was bought was not in accordance with Sections 12 and 14. Now, Section 12 simply says that the purchaser may take it to the analyst; but what did that matter? It was merely a mode of ascertaining the quality of the article; and Section 14 provides that the purchaser must give notice to the seller. That Toy did. After the article was bought, the seller said, "You have got chicory among it;" but that did not come within the protective clauses of the Act, because the Act says that a person selling an article shall not be guilty of any offence, &c., if he shall at the time of delivery of the article supply to the person receiving the same, notice by a label distinctly written on or printed with the article, to the effect that it is a mixture. It was therefore clear the case must go back to the magistrates, with the intimation from the Bench that their objections were not tenable, and that the case must be decided on its merits. Mr. Justice Field was of the same opinion, and thought it would be inconvenient if the case were decided otherwise, because clearly inspectors cannot be everywhere in their districts, and must require assistance. Order made accordingly but without costs, as the respondent did not appear.

Exact Words of Act must be used by Purchasers:—

At the St. Columb Petty Sessions, E. Henwood, of the Cornish Arms Inn, was summoned for adulterating beer with salt. Mr. J. R. Collins, of Bodmin, defended. It was proved upon the certificate of the County Analyst, Mr. J. H. Collins, of Truro (not related to defendant's solicitor), that the beer contained 74 grains of common salt per gallon, whereas no beer ought to contain more than 25 to 30 grains per gallon. Supt. Marshall, in his evidence, stated that when he asked the defendant's wife for the beer he told her he "intended to have it analysed." Mr. Collins contended that as the superintendent did not say the analysis was to be made "by the Public Analyst"—the words of the section—no conviction could take place. Supt. Marshall replied that he did use those words. Mr. Collins held that the bench must take the evidence as it was given; and the bench taking this view dismissed the case. The chairman, however, said that the decision was against the better judgment of the bench and refused the defendant's costs.

NOTES OF THE MONTH.

The Lewisham Board of Works has been reckoning up the cost of the Adulteration Act, and it finds that since 1873 its expenses have been £718 ; or, in other words, the enormous sum of £100 per annum spent to secure a pure food supply in the district. Naturally an immense outlay like this startled the board, and they thought it most unsatisfactory, especially because during all the seven years they had only caught 67 offenders, and they forthwith proceeded to propose the cutting down of the salary of their unfortunate analyst, because, apparently he could not make good things bad. We do not know whether the board ever dines at the expense of the rates, but if it does so, then £100 a year would be nothing for that purpose, of course, although £100 a year for the protection of the ratepayers is of course dreadful, and ought to be at once put down !

Had the board stopped here it would not have been much matter, but they proceeded to decide to trouble the other vestries with their nonsense, and spend money in sending copies of this report to all the Metropolitan Boards, asking them each to count up their costs, and have a conference on the subject, so spending more money, although with what object is not clear. Surely no money is better spent than that expended by the sanitary committees of the various vestries, and even if it ends in comparatively few " cases " being obtained, that should be a matter of congratulation, because it shows the food purveyors of the parish to be honest men, desirous of selling an honest article, and that the nuisances and other sources of disease are reduced to a minimum. Money is spent by the vestries— not to obtain the greatest number of convictions—but to act as a deterrent against fraud, and if that end be obtained, the happiest parish is that in which the fewest "cases" can be got, always supposing, of course, that the inspectors of nuisances really do their duty.

A most important decision has been recorded in the High Court of Justice, which our readers will find fully printed elsewhere. We hope that the attention of inspectors, and sanitary committees, under whose direction they act, will be given to this case, because one great difficulty is that the inspector may be watched, and the milk watered while he is safe in another part of the parish. If, however, some temporary deputies be employed, taking care to change them each time, no adulterator could ever say he was safe, even for an hour, and milk businesses would not be found to be so lucrative an investment as they are at present, according to the *Provisioner*, which states that some have been lately fetching the enormous sum of £8,000. We have heard of one district in which an intelligent woman, nicely got up with a neat market basket to hold the bottles, and a jug on her finger, did wonders in one day with the inspector following her, taking the filled bottles and giving her three empty ones after each transaction.

Here is an advertiser hoist on his own petard in an amusing manner : " Sausages that will keep sweet for some days during the hottest weather can be made with the aid of ———'s Food Preserver, at a cost of *not less* than a halfpenny a pound."

As will be seen from the reprint on another page, the State of Wisconsin has passed an Act to prevent adulteration, and it is very pleasing to find that it follows so closely the lines laid down by the English Act.

BOOKS, &c., RECEIVED.

Water Analysis, by Dr. Frankland; Supplement to a Handbook of Chemical Manipulation, by C. Greville Williams; Manual for the Physiological Laboratory, by Harris and Power; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal.

Owing to the pressure on our space this month, we are obliged to omit several articles already in *type, including one by Mr.* Carter Bell, " On the Manufacture of Citric Acid."

THE ANALYST.

JULY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, on Wednesday, 2nd June, the President, Dr. Muter, F.C.S., in the chair.

The Scrutineers having examined the voting papers reported that Mr. J. J. Eastick, Analyst to Fieldgate Sugar Refinery, had been elected as a Member.

The following gentlemen were proposed for election as Members :—

S. A. Goldschmidt, Ph.D., F.C.S., Analyst, of New York.

J. Blake White, M.D., Analyst to Health Department, New York.

The following papers were then read and discussed :—

"On Means for Increasing the Certainty of Perception of Colour Change in Various Titrations," by Dr. Dupré.

"On the Determination of Organic Carbon in a Water Residue," by F. P. Perkins.

"Note on the Analysis of some Samples of Chian Turpentine," and "On the Relation of the Scale of Baume's Hydrometer for Liquids Heavier than Water to the Specific Gravity," by G. W. Wigner.

"On Phosphoric Acid in Potable Waters," by O. Hehner.

NOTE ON A SIMPLE MEANS FOR INCREASING CERTAINTY OF PERCEPTION OF COLOUR CHANGE IN VARIOUS TITRATIONS.

By A. DUPRÉ, Ph.D., F.R.S.

Read before the Society of Public Analysts, on 2nd June, 1880.

As is well known, the change from pale yellow to red, in the titration of chlorides by means of nitrate silver with neutral chromate as indicator, is more distinctly perceived by gaslight than by daylight. No doubt eyes differ in regard to their power of perceiving slight variation of colour tint, and in my case I have always found it advisable, in the analysis of potable waters, containing from one to two grains of chlorine per gallon, considerably to concentrate by evaporation previous to titration, or else to perform the tritation by gaslight. The adoption of the following simple plan enables us, however, to perceive the change of colour as sharply and with as great a certainty by daylight as by gaslight.

The water is placed into a white porcelain dish (100 c.c. are a useful quantity), a moderate amount of neutral chromate is added (sufficient to impart a marked yellow colour to the water), but instead of looking at the water directly a flat glass cell containing some of the neutral chromate solution is interposed between the eye and the dish. The effect of this is to neutralize the yellow tint of the water, or, in other words, if the concentration of the solution in the cell is even moderately fairly adjusted to the depth of tint imparted to the water, the appearance of the latter, looked at through the cell, is the same as if the dish were filled with pure water. If now the standard silver solution is run in, still looking through the cell, the first faint appearance of a red colouration becomes strikingly manifest, and what is more, when once the correct point has been reached the eye is never left in doubt however long we may be looking at the water. A check experiment in which the water with just a slight deficiency of silver, or excess of chloride, is used for comparison is therefore unnecessary. The plan is useful chiefly with very dilute solutions, one or two grains of chlorine per gallon, and since I have adopted it I have entirely given up the concentration of the water prior to titration formerly practised.

A similar plan will, I think, be found useful in other titrations. Thus, in the case of turmeric, the change from yellow to brown is perceived more sharply and with greater certainty when looking through a flat cell containing tincture of turmeric of suitable concentration than with the naked eye. The liquid to be titrated should, as in the former case, be placed into a white porcelain dish. Again, in estimating the amount of carbonate of lime in a water by means of decinormal sulphuric acid and cochineal, the exact point of neutrality can be more sharply fixed by looking through the cell filled with a cochineal solution. In this case, the following is the plan I have found to answer best. The water to be tested—about 250 c.c.—is placed into a flat porcelain evaporating dish, part of which is covered over with a white porcelain plate. The water is now tinted with cochineal as usual, and the sulphuric acid run in, the operator looking at the dish through the cell containing the neutral cochineal solution. At first, the tint of the water and the tint in which the porcelain plate is seen are widely different; as, however, the carbonate becomes gradually neutralized, the two tints approach each other more and more, and when neutrality is reached they appear identical; assuming that the strength of the cochineal solution in the cell, and the amount of this solution added to the water, have been fairly well matched. Working in this manner I have found no difficulty (taking ¼ litre of water) to come within 0·1 c.c. of decinormal acid in two successive experiments, and the difference need never exceed 0·2 c.c. In the cell I employ, the two glass plates are a little less than half-an-inch apart.

A somewhat similar plan may be found useful in other titrations, or in fact in many operations depending on the perceptions of colour change.

ON THE DETERMINATION OF ORGANIC CARBON IN A WATER RESIDUE.

By Frank P. Perkins.

Read before the Society of Public Analysts, on 2nd June, 1880.

In the *Chemical News*, for April 23rd, the second part of a paper by Mr. W. H. Perkin appeared, "On the Analysis of Organic Bodies containing Nitrogen," * and as we read it, it occurred to us that the means there proposed may very readily be applied, and with some advantage, to the determination of organic carbon in a water residue, rendering what is now a somewhat tedious operation less troublesome.

The determination of organic carbon by Dr. Frankland's method, undoubtedly elegant though it be, requires costly and easily deranged apparatus. That devised by Professor Dittmar—an account of which is to be found in the *Chemical News*, for July 20, 1877, and also in *Frankland's Water Analysis*—while it does not require a special gas apparatus, has rather a complex arrangement of tubes, and scrupulous attention must be paid to every detail in order to obtain uniform results.

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* For the first part, see *Chemical News*, Dec. 26th, 1879.

It is to this process we turn and endeavour to lessen the attendant difficulties.

As it now stands, the process is essentially this—the residue is burnt in a current of purified atmospheric air, in a tube containing cupric oxide and a copper or silver coil. Of the gases evolved during combustion those not broken up and absorbed in the tube pass on through—

1. A small V tube, containing chromic and sulphuric acids.
2. A tube filled with calcic chloride.
3. A small weighed soda lime tube, where the carbonic anhydride formed during the combustion of the residue is absorbed.

The preparation of the combustion tube takes some time, from the necessity, if copper be employed, of igniting the coil in hydrogen when first used.

But we now have a mixture which will do double work and enable us to dispense with the copper or silver coil inside the tube, as well as the chromic acid tube outside. The author of the paper referred to has found that a mixture of potassic chromate and dichromate, together with cupric or manganic oxide (precip.), will break up the nitrogen oxides, and at a lower temperature will also absorb sulphurous anhydride. Directions for preparing the mixture are given by Mr. Perkin.

In working, we have used both manganic and cupric oxide, and the cupric oxide has given the best results. Charge then a combustion tube of rather small bore and drawn out at one end, with the mixture, leaving room for the insertion of a platinum boat at its posterior extremity; let this end of the tube be connected with a bulb apparatus or a Woulffe's bottle, containing potash solution, and let its drawn-out portion be attached to the following arrangement:—

1. A U tube filled with calcic chloride, the outlet of which is bent downwards at a right angle.
2. A straight tube filled with calcic chloride, the inlet of which is bent downwards at a right angle.
3. A small U tube filled with soda lime, and made in the following way:—

A piece of glass tubing, about ¼ inch internal diameter, is drawn out at one end to a small neck. A loose plug of recently ignited asbestos is now inserted, pushing it up nearly close to where the tube begins to decrease in diameter. The tube is then bent into the U form, and after filling it with soda lime another asbestos plug is put in, and this end also drawn out. A short piece of caoutchouc tubing is slipped over each termination, and two stoppers of glass rod are fitted into the tubing.

The U tube is now ready to be weighed. The one we use weighs about 16 grammes. The place it is destined to occupy is between the two calcic chloride tubes, but before attaching it the purity of the combustion tube must be proved. This is done by connecting the two calcic chloride tubes by a piece of caoutchouc tubing and the further one with an aspirator, and then drawing a stream of air, purified by passing through the potash solution, through the apparatus, the combustion tube being heated the while. When the air has passed for a time the rubber tubing is taken off, and a U tube, containing a little clear baryta water substituted in its place; if it is not rendered turbid, the tube is ready to receive the residue.

All that now remains to be done is to turn off the gas from the furnace, to replace the tube containing baryta water, by the weighed soda lime tube, to introduce the platinum boat containing the residue into the combustion tube, to connect it again with the vessel containing the potash solution, and conduct the analysis in a stream of air in the usual way, taking care, however, not to heat strongly the front part of the combustion tube. When the combustion is over, the soda lime tube is disconnected, the little glass stoppers are again inserted, and it is weighed; the increase in weight gives the amount of CO_2 in the residue. In a few minutes the combustion tube is ready for another experiment, and may be used many times without further trouble. The following determinations will show the degree of accuracy attainable. A blank experiment gave an increase of 0·0005.

EXETER WATER SUPPLY.

From the Main.	*Experiment 1.*	Organic Carbon	0·218	per 100,000.
	Experiment 2.	Organic Carbon	0·272	
	Experiment 3.	Organic Carbon	0·164	

In 1870, the same water analysed by Dr. Frankland gave, when—

Drawn from the Works		O.C. 0·366	per 100,000.
Drawn from the Main		O.C. 0·202	
Experiment 4.	250 c.c. of water, taken from a well four weeks after it had been pumped out in consequence of a drain having burst into it, were evaporated with the usual precautions; the residue gave	O.C. 0·927	per 100,000.
Experiment 5.	500 c.c. of the same water gave	O.C. 1·09	

REPORT ON THE ANALYSIS OF VARIOUS TINNED FOOD PRODUCTS.

Second Paper.

By G. W. Wigner, F.C.S.

The interest taken in my last paper induces me to publish some further results. The subject grows rapidly in importance, for year by year the food producing power of England becomes less as compared with its food consuming power, while the rapid decrease in cost of transport by sea and land enables produce to be brought over distances of thousands of miles at a cost which is but small compared with the value of the commodity.

In my last paper[*] I reported on one brand of tinned roast beef and one of boiled beef, and five other articles. I will commence again with meat.

8. Corned Beef (St. Louis Beef Canning Company). These tins are of a peculiar truncated pyramidal shape, which seemed at first calculated merely to increase the labour of tin making, but when a tin is opened it is found that the shape is advantageous, as the meat readily leaves the tin as if from a mould. The tins are very full, more so indeed than any other I have opened, and this should assist in keeping the meat.

The results of my analysis were as follows:—

Moisture		52·23	per cent.
Albuminoid substances		25·44	„
Containing nitrogen	4·07		
Fat		6·71	„
Ash		4·76	„

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[*] Analyst, vol. v., page 99.

The ash contained—

Salt (Chloride of Sodium)	3·00 per cent.
Phosphate of Lime	·85 ,,

It is evident that the meat is only moderately salted; and, considering that it is absolutely free from bone, it contains a very good proportion of phosphates. The moisture is but little more than two-thirds that of raw beef—the fat is less than one-fourth, while the albuminoids are very nearly twice as high. Comparing all the figures, it is a fair estimate to place the dietetic value at nearly twice as high as boneless fresh beef, and about two and one-third times as high as average joints of meat with bone.

The flavour is good. In the smaller tins especially it forms a handy reserve for a cold breakfast or luncheon dish. As to the retail price it appears to vary between 8d. and 10d. per lb. Taking the higher figure, this would correspond to about 4½d. per lb. for good sound meat, a lower price than our poorer classes now pay for the trimmings and refuse of a butcher's shop.

9. Cooked Beef Tongue (St. Louis). This is sold in tins, which are very similar to the corned beef ones. As a breakfast dish it is, I think, one of the best of all these tinned goods that I have recently tried. It is certainly superior in this respect to the rolled and pressed tongues, so common, and is, in addition, much cheaper.

The analysis showed:—

Moisture		51·58	per cent.
Albuminoid substances..		12·15	,,
Containing nitrogen	1·92		,,
Fat		7·28	,,
Ash		6·24	,,
Chloride of Sodium in ash	4·94		,,

This is therefore less salted than the average of ordinary dried tongues, and contains more nutritive matter than they do. It is well packed, so that it keeps for some days after the tins are opened.

10. Tomatoes.—This seems a suitable article to consider with the meat and tongue. I have tried two brands, one Thurbers' and one a French make, with no name on. Both are preserved in water. At first it appeared that this was in excessive quantity, but the whole tin, when analyzed, showed 5·52 per cent. of solid matters. Church gives the solid matter of ripe tomatoes at 10·2 per cent., so that the added water was probably not more than was really needed to fill the tin up when it had been closely packed with the tomatoes. The flavour of most of these has proved excellent, and in no case has there been any objectionable taste.

11. Soup should, perhaps, have been treated of before meat, but that I have less to say about it. The difficulty I met with has been to find a sample sufficiently mild in flavour. I have tried some half dozen kinds, but all are too strong for my palate; otherwise, as foods, they are certainly nutritious and fairly concentrated; the best of them forming a stiff jelly when cold.

12. Succotash, a thoroughly American vegetable preparation. It consists of a mixture of Haricot beans, Lima beans, and Maize cooked in the tin, and then soldered up; there is also a little fat added. The tin wants simply heating in water before dishing.

The analysis showed :—

Water		74·58 per cent.
Albuminoid matters		3·60 „
Containing nitrogen	·576	„
Cellulose		1·66 „
Ash		·75 „

It is, therefore, a very good specimen of a boiled vegetable food, and a palatable change from our winter monotony of potatoes and greens.

There are several more analyses to report yet, but the space at my disposal is too limited for them this month.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879	Name of Patentee.	Title of Patent.	Price
3697	A. M. Clark	Electric Lamps or Regulators	1s.
3750	H. J. Haddan	Electric Lamps or Regulators	8d.
3794	A. White	Apparatus Employed with Telephones	6d.
5535	Ditto	Telephones	6d.
3803	G. J. Wells	Manufacture of Caustic Alkalies	6d.
3804	W. J. Menzies	Manufacture of Caustic Soda, and Potash	6d.
3836	W. R. Lake	Production of Power from Bisulphide of Carbon	10d.
3938	Ditto	Manufacture of White Lead	6d.
3875	C. W. Harrison	Electric Lighting	6d.
4078	W. T. & J. Chadwick	Manufacture of Sulphate of Alumina	4d.
4087	J. H. Johnson	Manufacture of Aluminium and Magnesium	2d.
4122	R. Lancaster	Manufacture of Alkalies	2d.
4162	W. Cormack	Utilizing Spent or Acid Liquors	2d.
4221	A. Dupré	Manufacture of Sulphate of Potash	2d.
4253	A. J. Boult	Manufacture of Magnesia	4d.
4338	G. N. Tucker, &c.	Manufacture of Ammonia and its Salts	8d.
4402	W. F. Nast	Extracting Ammoniacal Salts	6d.
4405	A. V. Newton	Electric Lamps	6d.
4440	J. H. Hohnson	Telephones	2d.
4544	B. E. R. Newlands	Manufacture or Refining of Sugar	4d.
4637	W. Morgan Brown	Manufacture of Sulphate of Lime	6d.
4611	W. A. Barlow	Manufacture of Hydro-oxide of Carbon by the direct introduction of Liquid Protoxide of Hydrogen	6d.
4781	F. J. Bolton and J. A. Wanklyn	Manufacture of Artificial Manures and Ammoniacal Products	4d.
1880.			
810	J. Pattinson	Regulating the Explosion of Compounds containing Chlorate of Potash	2d.

Hehner's Alcohol Tables.—We print this month the last pages of the Alcohol Tables, calculated by Mr. Otto Hehner, which we have been publishing month by month since March. Our subscribers will note that the paging is so arranged that it will bind with the March Number. The Tables have proved so useful, that Mr. Hehner has decided on publishing them separately in pamphlet form. They may be *procured of Messrs. J. & A.* Churchill, 11, New Burlington Street, W.

REVIEWS.

Nature's Hygiene—a series of essays on popular scientific subjects, with special reference to the Chemistry and Hygiene of the Eucalyptus and the Pine.

By C. T. Kingzett, F.C.S. London: Baillière, Tindall & Cox.

The author of this book must surely have enjoyed the writing of it as a huge practical joke; and the idea of getting people to buy a "series of essays on popular scientific subjects," and then leaving them to discover that they have purchased an ingenious advertisement for a disinfectant, called *Sanitas*, must have tickled him immensely. Seriously, from a scientific point of view, the book is altogether beneath criticism, unless we are to admit that all the labours of others on ozone were only mere preliminaries to the grand discovery of the author, which is to save mankind from all diseases, and consists in blowing air through turpentine and warm water, and then bottling and selling the product under an attractive name. In the whole book we find plenty of Andrews, Day, Pasteur and other authors, and towards the end we meet a little of Kingzett, but he is comparatively smothered in the sea of quotations necessary to aid the large and open type in turning the materials for a pamphlet into the size of a book. The concluding paragraph but one is delicious, and is as follows:—"It is possible to dwell very largely on this theme, but it is hoped that enough has been said and sufficient evidence brought forward to prove conclusively that among the processes of Nature's hygiene there are few more extensive or important than that by the study of which the author was led to the discovery of the disinfectant named Sanitas."

Alphabetical Manual of Blowpipe Analysis, showing all known methods, both old and new.

By Lieut.-Colonel W. A. Ross, late R.A. London: Trübner & Co.

The rapidly increasing notice which is being taken of this subject by British chemists has encouraged the author of *Pyrology* to publish another manual. The book is of a handy size, and a large mass of information is conveyed in its 145 pages, the whole being arranged under heads placed alphabetically in dictionary form. The work opens with a dedication to Prince Bismark, which perhaps somewhat too strongly exalts the intelligence of foreigners as compared with the author's own countrymen, and states how that, unable to obtain proper training in blowpipe analysis at home, the author had to seek it at Frieburg University. The book proper begins with a condensed scheme for a general course of examination, classified under the respective heads of the articles and re-agents used, and then the various special subjects are treated alphabetically. Among the most useful articles are those on the beautiful re-actions obtainable on the aluminium plate, an excellent table of the constitution of the alloys, and a very full but concise arrangement of the minerals under the head of their chief metallic constituents. The article on pyrochromes is also furnished with a concise, but very complete, table of coloured flames. Every practical point is well treated, and the directions are short, distinct and easily followed. The article directed to show how to distinguish between the true colour of sodium and the false yellow produced by perfectly clean wires, is good, and in it the author claims the superior accuracy of the blowpipe over the spectroscope for this purpose. To save space, certain abbreviations are employed, a table of which is given at the opening of the book: thus, we have H.P. for the reducing flame and O.P. for the oxidising one; but why we should have HS for H_2S is a mystery, and is a step in the art of abbreviation calculated more to confuse than to shorten.

The whole ends with a set of specimen exercises from the Frieburg course, and so that our readers may see whether the enormous advance in blowpipe work claimed for that laboratory over our native ones is altogether so great, we append the steps in order, as here shown, to be applied in an analysis of crystallized apatite:—

1. Agate mortar and boracic acid bead.
2. Potassium carbonate on aluminium plate and boil with water.
3. The dried residue in boracic acid bead (for Ca as chief base).
4. Specks of potassium carbonate to the same bead.
5. Potassium pyrotungstate (for phosphate).
6. Original with crystals of phosphoric acid in a glass tube (for fluorine).
7. Paste of powder on plaintum wire in inner flame and then on copper wire (for chlorine).

Taking the book as a whole, it will be found very useful for reference and a great aid to a chemist in rapidly obtaining a qualitative idea of the contents of any mineral he may receive for full analysis, and thus enabling a speedy decision as to the course of ordinary quantitative analysis it will be best to follow.

Manual for the Physiological Laboratory.

By Vincent Harris, M.D., and D'Arcy Power, B.A., Oxon.

Baillière, Tindall & Cox, King William Street, Strand.

This little book will be found very useful to medical students preparing for examination as an excellent "cram" on histiology and practical physiological chemistry. It is divided into three sections, the first being devoted to practical directions for hardening, staining and mounting tissues; the second to practical histiology of all the tissues and organs of the body; while the third deals with the chemistry and tests for the various albumens, peptones, and all other chemical compounds found in the various secretions of animals. Taking it as a summary, it is certainly very complete and concise, a good deal of information being compressed into the 125 closely printed pages it contains. Here and there we find an omission of something, the presence of which would be desirable; for instance, in the analysis of urinary calculi, where we are simply told that if the stone burns entirely away it is probably uric acid, but no mention is made of the several other organic calculi frequently met with, such as cystine, xanthine and fatty masses which are surely matter not overlooked by examiners. Considering the book as a whole, however, it is to be pronounced an excellent attempt to summarise the extensive subject with which it deals, while the directions for mounting, &c., are most excellent.

Supplement to a Handbook of Chemical Manipulation.

By C. Greville Williams, F.R.S.

Van Voorst, Paternoster Row.

This is a pamphlet of some eighty pages, which we ought to have noticed some time ago. The greater portion consists of very brief notices of new apparatus, or modified forms of apparatus which have been introduced since the author's *Handbook* was published. These notices are condensed, but still quite sufficient to guide those who have not the opportunity of seeing every new device for saving labour, or increasing the accuracy of work where to obtain the fuller information. A few pages are devoted to short notices of processes of *comparatively recent date.*

Water Analysis for Sanitary Purposes.

By E. Frankland, Ph.D., D.C.L., F.R.S.

Van Voorst, Paternoster Row.

This volume is a complete description of Dr. Frankland's well known process of water analysis. References to other processes or methods are hardly to be met with in the book, and the controversial matter, which has given so much rancidity to many of the previous publications on organic carbon and nitrogen, is most studiously avoided. We do not notice that any new feature has been introduced into the process, but we suppose the author could scarcely have anything to add, after the papers and discussions to which it has already given rise. The value of the book lies in the fact that, for the first time, the process is published alone, and in a handy form for reference.

LAW REPORTS.

Can a Public Analyst Appoint a Deputy ?—

William Fitz, of Clifton, appeared at the Bristol Police Court, on May 20th, in answer to an adjourned summons, charging him with selling to Joseph Bruce, two quarts of milk, which was not of the nature and quality demanded. Mr. Wansbrough supported the summons, as solicitor of the Bristol and West of England Dairymen's Association. Mr. Clifton appeared for the defence. When the case was first before the court Mr. Wansbrough proposed to put in the certificate of Mr. Gatehouse, the analyst of the city of Bath, to prove that the milk purchased by the complainant was not of proper quality. Mr. Clifton objected to the admissibility of the document, on the ground that Mr. Stoddart, the analyst of Bristol, was the proper person to have made the analysis. On this point the summons was adjourned. At the re-hearing, the court decided to have the arguments gone through again. Mr. Wansbrough proposed to proceed with the facts, but this was objected to by Mr. Clifton, on the ground that the point in dispute was a legal one, and should be first decided. Mr. Wansbrough said since the adjournment he had looked carefully into the matter, and thought that the magistrates would be of opinion, when they heard what he had to advance, that the case came clearly under sec. 12. They were compelled to go to another analyst because Mr. Stoddart was not acting at the time the milk was submitted to Mr. Gatehouse. He (Mr. Wansbrough) was prepared to show that Mr. Stoddart at that time was in such a state of ill-health that he could not be said to be acting. Their Worships had the Act of Parliament before them, and he thought they would agree that it contemplated such an emergency as the analyst being ill, and the complainants were therefore justified in going to the analyst of the nearest place, and by their so doing no injustice was done to any person. Looking at the state of Mr. Stoddart's health, he asked the Bench to say that that gentleman was not acting. Mr. Clifton followed on the other side, and urged that Mr. Wansbrough, in his interpretation of the Act, had overlooked certain inviolable conditions. The person who held the position of analyst could not delegate his duties to another person unless there was express authority given by the body in whose hands the original appointment was vested. If they examined the Act, nothing could be found authorising the appointment of a deputy other than in the way which he had advanced, viz., by the Town Council. Mr. Stoddart had been properly installed by that body, and it must be taken that he was acting as such until from some cause or other the post became vacant. If Mr. Stoddart was the analyst of Bristol—and his contention was that that was so—the certificate of Mr. Gatehouse could not be admitted. The Chairman, addressing Mr. Wansbrough, said the court was of opinion that before they could deal with the certificate evidence should be taken to prove that Mr. Stoddart was not acting at the time. Joseph Bruce was called, and on being sworn he said he was an inspector in the employ of the Association. In the month of April he purchased two quarts of milk of the defendant, and took a sample to the laboratory of the City Analyst, Park Street. He did not see Mr. Stoddart, and was informed by the assistant that that gentleman was ill. The assistant refused to take in the samples. Mr. F. W. Stoddart, son of the City Analyst, was next called, and proved that since April his father had been too ill to attend to the duties of the office, and Mr. Gatehouse had been appointed by his father to act. In answer to the Bench witness said that Mr. Gatehouse had not been appointed to act for general purposes, but only for the Milk Association. Mr. Clifton objected again that such an appointment was a legal one. After further discussion the Magistrates declined to further adjourn the proceedings, and dismissed the summons. It is probable that the case will be taken to a superior court.

Conviction for Selling Adulterated Coffee, although labelled Mixture of Chicory and Coffee:—

At the Wolverhampton Police Court, on June 3rd, John S. Beddow, grocer, of Victoria Street, Wolverhampton, was summoned for selling an article not of the nature and substance demanded by the purchaser. The Town Clerk prosecuted, and Mr. J. Rowland, defended on behalf of the Birmingham and Midland Counties' Grocers' Protection Society. The witness for the prosecution said he went to the defendant's shop, and asked for a half-pound tin of coffee. The tin was afterwards handed to the Borough Analyst, who certified that the contents were an admixture of chicory and coffee, and the proportion of chicory being 47 per cent. It was stated that the tin was covered with a coloured label, on which was printed in large type, "French Coffee." There was a notice in small type that the contents were a mixture of chicory and coffee, but such notice was concealed by a wrapper of yellow paper. Mr. Rowlands, for the defendant, stated that the mixture was bought from Messrs. S. Hanson, Son, Evison, and Barter, wholesale grocers, of Botolph Lane, London, and was largely sold by grocers throughout the country. It was well known that all tinned coffees were mixed with chicory. He called Mr. G. Shelley, of Hockley, and Mr. John Simmons, wholesale grocer, of Birmingham, who both said all tinned coffees were supposed to be mixed. Mr. Evison, a member of the firm who prepared the mixture, said they sold about a ton weekly. The Mayor said the magistrates were of opinion that the contents of the tin was a fraudulent mixture, and that the label, which was printed in so small type as to be scarcely visible, was not sufficiently plain as to the contents of the tin, and they therefore fined the defendant £5 and costs. Mr. Rowlands asked for a case, which the magistrates refused to grant, and notice of appeal was then given.

How Co-operative Societies earn their Dividends:—

At Forfar Sheriff Court, on June 7th, Sheriff Robertson president, David Mollison, salesman to the Forfar Equitable Co-operative Society, was charged with selling as salt butter a substance not of the nature, substance, and quality demanded. The Supt. of Police said he asked for a pound of salt butter, and paid 1s. 4d. for it. It had a beautiful appearance and was sweet and delicious to the taste, but the analyst reported that it was adulterated with fat other than butter to the extent of not under 75 per cent. One of the members of the managing committee of the Society said they had been swindled by the man from whom they purchased this butter. They paid 118s. per cwt. for it, the same price that was charged for the finest Canadian butter. They had previously had butterine, for which they paid 90s., but each keg was marked as the finest Canadian butterine. The Committee had ordered the manager to buy no more butterine, as they intended to sell nothing but first-class butter. The Fiscal: What became of this butter? Witness: It was nearly all sold out before this sample was taken. I fancy it is all away by this time. The customers seemed to be well pleased with it. We have intimated to the seller that we are not to pay for it as butter. The Sheriff: Then you have made a large profit on this. Witness: But we have to give a large dividend. We must put on the profit somehow. The Fiscal: The members of the Society are their own customers, so that they are just cheating themselves. The Sheriff said the Society ought to be more particular in the appointment of their purchasing committee, as he believed that if they had shown reasonable diligence they would have detected that this was not butter. He found the charge proved, and imposed a penalty of £5.

Inspector Testing Samples before Submitting them to Analyst:—

At Poole Petty Sessions, James Cobb, milk seller, of Longfleet, was summoned for selling adulterated milk. Mr. Dickinson, Town Clerk, appeared in support of the information. John Hutchins, the inspector, stated that on the 24th May he purchased half a pint of milk from the defendant. He forwarded a portion to the Public Analyst, Mr. J. Comyns Leach, whose certificate showed that it contained 9 per cent of water. He asked the defendant for new milk, such as he supplied to his customers, and in reply he said he supplied it to them as milk and water. He had nothing to indicate that. Mr. Hutchings, in answer to the Mayor, said he had obtained samples from at least 20 other milk sellers, but on testing them with the lactometer he found there was no necessity to send the samples to the analyst. Mr. Dugdale suggested to the defendant that he should get one of those instruments for his own protection, so that he could see for himself what was the quality of the milk he supplied. The defendant replied that he knew very well, after selling milk for so many years, what was good milk and what was not good. The milk sold to Mr. Hutchings was as pure as could be got, but there was a certain quantity of water in all milk, and he merely told the inspector that it was milk and water for his own protection. The Mayor fined him £1 and costs.

NOTES OF THE MONTH.

In another column we print a decision of the Bristol magistrates to the effect that in the illness of their own analyst it was impossible to prosecute on the certificate of a neighbouring analyst. As usual in such cases much extraneous matter was introduced by the legal gentlemen, and it was argued whether an analyst could or could not appoint a substitute. All this is quite foreign to the question which resolves itself into the right of the public to take a sample to an adjoining analyst in event of there being no analyst appointed for the district. This right is clearly recognised by the Act, and surely in both common sense and law the illness of the appointed analyst causes a state of things on all fours with there being no analyst. We trust that for the public sake this case will be pushed to an appeal, so that an authoritative decision may be obtained, establishing the right in question, as we have no doubt it will be easily if the strict point be adhered to. It is not a matter of the power of an analyst to delegate his functions, but of a right on the part of the public to seek aid elsewhere, if either there be no analyst for the district, or if he be temporarily laid on the shelf by ill-health. Section 12 of the Act surely covers the case.

Our friend the *Grocer* is getting moral. A case, which will be found detailed elsewhere, was decided lately, and was considered worthy of being reported by the *Grocer twice in the same number*; so, of course, it must be very important, considering the great value of that organ's space. In this trial it has been held that to sell coffee and chicory as French coffee, with a notice of admixture in very small type, and covered by an outer wrapper is illegal, and the party whose ingenuity suggested the expedient has been fined. The case being under appeal, any comments of ours must, of course, be reserved, but our readers will, we think, be amused by the grand opening of the lawyer for the defence who appeared for the trade society. He stated that he had not come to defend a fraudulent transaction. *The association, which he had the honour of representing, was formed to prevent fraud amongst its members, and, as far as possible, to protect the public.* Fancy that now, when no protection societies existed before the passing of the Act, and so it is only when the legislature steps in to protect the public, that the grocers magnanimously assist it by employing their funds to defend a firm who label an article a mixture, and then cover up the label with yellow paper!

Another case has occurred in Forfar, in which the salesman at a co-operative store was fined for selling "butterine." A member of the managing committee said that "They had to pay large dividends and so had to get the profit somehow," and the Fiscal then exclaimed with great dryness that "The members of the society are their own customers, so they are just cheating themselves!" How can we wonder at traders being tempted when immaculate co-operators go in for mutual cheating.

In Dorsetshire they have an analyst, but the inspectors also act as analysts, and take care that he shall make no mistake, by testing all the milk they take by a lactometer, and only sending the analyst those samples which they deem necessary. How beautifully skim milk must pass in Dorset for the finest new article, and what must be the awful conflict of authority when the inspector gets a milk with excess of cream and forthwith finding it show adulteration, sends it on to the analyst, who thereupon returns it good. In this case who is to be believed by the local authority—the inspector or the analyst? Seriously, this is an innovation which is at once illegal and unjust to both traders and the public.

We take the following two paragraphs from the *Cowkeeper and Dairyman's Journal*, a new periodical devoted to the interest of the milk trade:—

To unprejudiced minds it appears somewhat inconsistent to appoint a dairyman (in an outer suburb of London) as inspector under the Sale of Food and Drugs' Act. This arrangement does not appear to give satisfaction to other members of the trade in the locality who, perhaps not unnaturally, object to their samples being continually taken by one of themselves, and the natural inference that concocted samples of the Inspector's milk are submitted for analysation is generally believed.

There is no analyst in Bristol, and the underselling milk and water dealers are having a good time of it, as milk is being sold at any price—from 2d. a quart—and great injury is being done to the trade generally. Bristol wants a new analyst at once, or some of the interlopers will by their abominable adulterations be the cause of grievous results to the public.

NEW TEST FOR ALOES.

Hugo Borntraeger has recently described* a test for the detection of aloes, which we have no doubt will prove extremely useful. The liquid, or the cold alcoholic extract of the suspected solid, is shaken up with about twice its bulk of benzol. The benzol, which in the presence of aloes assumes a yellowish green colour, is taken off with a pipette, and agitated with a little strong ammonia. The ammonia will now assume a fine violet red colour, even if not more than one part of aloes had been present in 5,000 parts of the liquid. The red colour is destroyed by acids but restored again by alkalies. Other caustic alkalies may be employed, but none yield such good results as ammonia. In the use of beer the presence of aloes can be demonstrated, without any previous preparation, provided about 14 grains of aloes had been added to the gallon.

Death of Mr. W. W. Stoddart.—It is with much regret we record the death of this gentleman, which took place at his residence, Sneyd Park, on 30th May last, from disease of the heart. Mr. Stoddart carried on the business of chemist and druggist in North Street for a considerable time before he took the public appointment of City Analyst, on the passing of the Act against adulteration. The deceased gentleman was analyst for the county of Somerset as well as for the city and county of Bristol. Mr. Stoddart was a F.I.C. and a F.G.S. He was in the 57th year of his age.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; The Plumber and Sanitary Engineer; The Cowkeeper and Dairyman's Journal.

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* *Zeitsch. f. Anal. Chem., 1880, 165.*

THE ANALYST.
AUGUST, 1880.

SOCIETY OF PUBLIC ANALYSTS.

THE NEXT MEETING of this Society will be held at Swansea during the week of the British Association Meeting, probably on Friday the 27th inst., but the usual circular notice will be sent to the Members.

ON PHOSPHORIC ACID IN POTABLE WATERS.

By O. HEHNER.

Read before the Society of Public Analysts, on 2nd June, 1880.

IN January, 1879, I had the honour to describe before the Society a method for the determination of Phosphoric Acid as Phospho-molybdate,* and which in the main consisted in the precipitation at a low temperature of the phosphoric acid by molybdic solution, dissolving the precipitate, after washing with the least possible quantity of water, to neutrality, in dilute ammonia, evaporating the solution thus obtained with repeated addition of small quantities of water, and weighing the resulting residue. This, divided by 28·5, as I showed by numerous test experiments, very accurately indicates the amount of phosphoric acid. The method is evidently better adapted for the estimation of very small quantities of P_2O_5 than of more tangible amounts, since the compound ultimately weighed contains but a small fraction of phosphoric acid, a minute quantity of that acid furnishing a highly multiplied amount of residue, and also because we are already in possession of very excellent methods for the determination of P_2O_5, when occurring in moderately large quantity. The method, in fact, allows us to deal with quantities so small as to be quite unassailable by the usual magnesia process.

One of the chief objects I had in working out the method referred to, was to be in possession of reliable means to determine the proportion of phosphoric acid occurring in potable waters.

All unbiassed chemists are in the habit of basing their opinion as to the quality of given samples of water upon the figures resulting from a considerable number of different determinations, embracing chiefly the amounts of organic matter or some data measuring the same, their products of oxidation, and of some of the mineral substances invariably met with in sewage, namely, chlorides and sulphates, but the determination of that most important of the constituents of animal excreta—phosphoric acid—has been sadly neglected, although, to quote Mr. Wanklyn, "much nonsense has been talked about phosphates in drinking water." The fact is, that, as far as I am aware, the whole literature of water analysis does not include a single *quantitative* determination of phosphoric acid in drinking water, although in some cases the precipitate thrown down by ammonia has been put down as "iron, alumina, and phosphates" (Graham, Miller, and Hoffmann.) In mineral waters that acid has been again and again determined, but its estimation with a view to aid in the formation of a correct opinion on samples of drinking water has not, so far as I can ascertain, been systematically undertaken. The present paper is intended to form a first step in this direction, but it is put forward only tentatively and suggestively.

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* THE ANALYST, vol. iv., p. 23.

Wanklyn states, that "the fact has been overlooked that, except as infinitesimal traces, phosphates cannot exist along with carbonate of lime in a clear water." Now we may assume, that in presence of carbonate of lime phosphoric acid would be present only as tricalcic phosphate. One part of this, according to Voelker, is soluble in 12,500 parts of pure water, or 100,000 parts of water might contain no less than 8·66 of P_2O_5, whilst the solubility is far greater still in the presence of ammonium salts, chloride of sodium, &c. It is also much increased by carbonic acid, never wanting in natural waters. R. Warington (*Chem. Soc. Journ.* [2], ix., 80) gives the solubility of tricalcic phosphate, taken in the form of bone ash, in water saturated with carbonic acid, as 1 part in 6,788, or 6·75 P_2O_5 in 100,000 parts of water.

Hence the quantity of P_2O_5, which may possibly occur in polluted drinking water, is by no means "infinitesimal." It will be seen that I have not met with any water containing anything like the quantity theoretically possible, but yet amounts were found which were not only quite appreciable, but quite as large as those of many other mineral constituents which we are in the habit of measuring.

In all cases the water analysed was perfectly clear, and had, when necessary, been freed from flocculent matter by filtration. A litre was employed whenever practicable, evaporated with the addition of nitric acid, first over the naked flame, then to dryness on the water-bath, to separate the silica, the residue taken up with a little nitric acid, the solution filtered through the smallest practicable filter, evaporated until but a few drops were left, and precipitated with molybdic solution. In such waters as contained much chlorine, this was as nearly as possible removed by repeated evaporation with nitric acid. In the case of samples highly charged with sulphate of lime the volume of liquid precipitated by molybdic solution was necessarily larger, to prevent the separation of the sulphate. The whole of the samples contained carbonate of lime.

In the following tables the samples are roughly classified under three heads. Class I., good and fairly good water; II., waters of low quality; and III., waters plainly polluted.

All figures are parts per 100,000.

I.

	Cl.	SO_3	N_2O_5	Free NH_3	Album. NH_3	Total Sol.	P_2O_5
Uxbridge Water Supply (deep chalk springs)............	..	..	..	..	..	..	None
New River Water	..	..	..	..	..	..	0·008
Lambeth Water Company's Supply	..	..	..	..	..	..	0·020
Chalk	1·65	0·95	1·91	0·002	0·002	32·6	0·021
„	1·60	0·38	1·84	0·001	0·001	32·6	0·023
....	1·69	3·50	0·33	none	0·003	27·3	None
....	2·00	0·74	3·15	0·001	0·005	36·7	0·035
....	3·39	2·61	3·29	0·002	0·010	27·2	0·034
....	5·00	6·78	3·26	none	0·002	51·9	0·020
....	11·30	6·87	3·18	none	0·004	53·1	0·018
....	1·40	0·51	2·95	0·006	0·010	35·3	0·059
....	6·12	1·27	1·69	0·005	0·001	40·3	0·074

II.

	Cl.	SO_3	N_2O_5	Free NH_3	Album. NH_3	Total Sol.	P_2O_5
…………………………	1·72	3·43	2·68	none	0·015	53·4	0·108
…………………………	5·43	3·11	2·38	0·007	0·014	39·4	0·045
…………………………	7·83	1·78	5·12	0·001	0·004	52·9	0·022
…………………………	5·90	24·83	6·70	0·003	0·006	107·9	0·033
…………………………	12·19	2·80	3·36	none	0·013	67·4	0·028
Water from Thames at Nine Elms Station, Half Ebb ….	..	..	..	..	..	..	0·078
Ditto, Half Flood …………	..	..	..	..	..	..	0·043

III.

	Cl.	SO_3	N_2O_5	Free NH_3	Album. NH_3	Total Sol.	P_2O_5
From Thames at Crossness ….	306·7	37·2	not determ.	0·112	0·016	648·8	0·240
….	11·8	17·69	3·47	0·022	0·014	90·7	None
….	24·95	36·14	21·03	0·032	0·065	234·6	0·484
….	3·34	4 27	3·75	0·029	0·013	28·9	0·025
….	7·60	21·77	0·04	0·073	0·004	74·3	0 025
….	3·20	4 29	3·24	0·049	0·011	55·8	0·070
….	11·06	19·60	19·89	0·288	0·013	117·8	0·100
….	12·36	2·81	20·51	0·005	0·021	116·6	0·039
….	10 70	17·38	15·97	0·001	0·033	120·0	0·553

On examining these figures, it will be seen that in really good waters the amounts of phosphoric acid are very small, the numbers being in all cases, with the exception of two, less than 0·4 per million. The two exceptions were waters which were not absolutely free from suspicion of pollution. Some of the waters of Class II., although high in nitrates, contain but little P_2O_5, but the majority of the undoubtedly polluted samples contain more than one unit per million; in one case, that of a highly polluted well, as much as 5·5. In several of these samples the phosphoric acid is, however, very low, and from one even entirely absent. This may be due to one or both of two circumstances. Either the pollution is due to vegetable matter, or the phosphoric acid has been removed by vegetation or precipitation. One sample, however, which is not included in the table, although known to be sewage polluted and giving a thick brown precipitate with Nessler's re-agent, and abounding in chlorides and sulphates, contained but 0·39 parts per million.

On the whole, therefore, the figures go to show that the presence of phosphoric acid in larger quantity than 0·5 per million parts of water should be regarded with suspicion. On the other hand, the absence of phosphates affords no positive proof of the freedom from pollution.

The determination of phosphoric acid by means of the process which I have employed being so simple a matter, requiring so little water, and being capable of furnishing the analyst with a valuable help in forming an opinion as to the quality of drinking water, but I hope this communication may be the means of directing the attention of chemists to this but too much neglected constituent of potable water.

ON THE COMPARISON OF THE SCALE OF BAUME'S HYDROMETER FOR LIQUIDS HEAVIER THAN WATER WITH THE SPECIFIC GRAVITY.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts on 2nd June, 1880.

Baumé's hydrometer is probably in more general use in chemical manufactories, and especially in sugar refineries in this country, than any other of the numerous arbitrary scales that have been from time to time proposed for determining the density of liquids. From a scientific point of view there is of course an objection to any arbitrary scale, based simply on the fact of its lacking a scientific basis, but a worse objection than this almost invariably arises from these arbitrary scales being from time to time altered or amended (which amendment in fact is only alteration under another name), so that it is difficult to secure instruments which shall correspond to the original or any other definite empirical standard.

This is especially the case in reference to Baumé's hydrometer, for, at the present time, it is possible to procure instruments which are guaranteed by the makers to be accurate, and which certainly are so far accurate that they correspond to the tables according to which the instruments have been constructed, and yet these instruments when purchased at different places show at the medium points of the scale differences corresponding to nearly 3°, while in the case of heavy liquids, such for instance as concentrated sulphuric acid, the indications vary more than 4°.

The English text-books contain but little information either as to the derivation of the original scale or the reasons for the different alterations that have been made in it. This is perhaps owing to the fact that scientific chemists in this country have shown less favour to such arbitrary scales than has been the case on the Continent. In America Casamajor has written and published several excellent papers on the subject, some of which have been reproduced in a monthly journal published here called the *Sugar Cane*. In France, Vacher, an instrument maker, has written two or three short papers on the subject, and on the allied subject of the effects of changes of temperature on the hydrometer readings. These publications, although good of their kind, are of comparatively little value to us in this country, because we have to face at the outset of the enquiry the plain fact that the so-called Baumé scales in use in this country, in France, and in the United States, differ very greatly from each other. Our national standards render no assistance in the matter, because if a Baumé hydrometer is sent to Kew for examination the report is simply + or — so many degrees, "*according to Dr. Ure*," thus falling back on an old, and I might say also, an obsolete table.

The cause of these discrepancies and this lack of a standard, arises no doubt from the wholly empirical manner in which the scale was originally formed by Baumé. A solution of salt was made, containing 15 parts by weight of salt in 100 parts by weight of liquid, and the hydrometer being floated first in pure water and then in this solution the space between the two points at which the level of the liquid stood was divided into 15 equal parts, and the scale continued both upwards and downwards. When this scale was continued upwards it was found that with a liquid having a sp. gr. of 1·520 the hydrometer marked 52°, and sulphuric acid of sp. gr. 1·845 marked 69½.

After a short time this mode of adjusting the starting-point of the scale was found to be inconvenient in practice, and concentrated sulphuric acid was adopted instead by Gay Lussac. The sulphuric acid, which was taken for the comparison, was assumed to have a sp. gr. of 1·845 at a temperature of 60° F., and to mark 66° on the Baumé scale instead of 69½. The difference between the level at which this hydrometer floated in the acid and in water was divided into 66 equal parts, and hence another scale arose, according to which a liquid having a sp. gr. of 1·440 will mark 44° on the Baumé hydrometer.

Here, therefore, we have the two extremes, one in which 52° corresponds to 1·520, the other in which 44° corresponds to 1·440—the former the original scale, and the latter the scale at present in use in France, and to some extent in America, and also an imperfect, but I think quite accurate, account of how the different scales arose. Now both of these scales were empirical, and instrument makers in adjusting the instruments used more or less pure salt, *i.e.*, chloride of sodium, or common commercial salt, and more or less concentrated sulphuric acid, and so got scales differing within rather wide instrumental errors from these.

Many years ago—how many I cannot say, but probably not less than 15—an ingenious London hydrometer maker endeavoured to solve this difficulty by halving the difference, *i.e.*, he graduated his spindles so that 48° corresponded to 1·480, or just half way between the two extremes already referred to, and thus another entirely different scale was originated, according to which a liquid of sp. gr. 1·845 marks nearly 68° Baumé. This compromise scale, as I may call it, is strange to say the one which has for the last ten years or more been in almost exclusive use in England, and certainly as far as the sugar industry is concerned it has entirely superseded the use of the two older scales, namely, Baumé's original and Gay Lussac's. It naturally follows from this that out of some 24 different tables showing the comparison between Baumé degrees and specific gravity which have been published in this country, 12 or 14 different scales have been adopted, which naturally range themselves into three different groups.

First.—A group of which Ure's *Dictionary* is the type, and which adopted very closely Baumé's original figures—Ure, Fownes and Cooley in fact differing only in the second and third places of decimals.

Second.—A group in which the amended scale of Gay Lussac, as adopted by the French, has been taken as the starting point, and of which an illustration is given in another table published in Cooley; in a table published in Griffin's *Catalogue*; and in Squire's *Companion to the Pharmacopœia*. In these tables again the differences are mostly confined to the second and third places of decimals.

Third.—A group which finds fewer representatives among the published tables, but is nevertheless the scale, according to which, with slight variations, nearly all the instrument makers in London and other parts of England have for many years past constructed their instruments, and which holds the intermediate place between the last two groups.

I have recently compared a number of hydrometers graduated on Baumé's scale, and in practical use by manufacturers in England, and I find that, excluding slight instrumental errors, they are all graduated according to this scale, and it is therefore a matter of importance to be able to translate the degrees of this directly into specific gravity. This can be readily done by the following formula:—

$$\text{Sp. gr.} = \frac{148}{148 - d.}$$

Where *d* equals the number of degrees on the scale of the instrument, the formula is in reality another way of expressing the fact that 48° Baumé corresponds to a specific gravity of 1·480 at the temperature of 60° F.

This table is in fact the one which, by universal consent of makers of instruments and chemical manufacturers, is now recognised as the English Baumé scale. All that I have done to it has been simply to re-calculate the figures on a true basis, which in some cases alters the scale by a small decimal from that according to which *some* of the instruments are graduated, but in the best instruments these figures will be found to be perfectly correct.

1	1·0069	25	1·2032	49	1·4949
2	1·0137	26	1·2131	50	1·5102
3	1·0207	27	1·2231	51	1·5257
4	1·0278	28	1·3333	52	1·5416
5	1·0348	29	1·2437	53	1·5579
6	1·0422	30	1·2542	54	1·5744
7	1·0496	31	1·2650	55	1·5914
8	1·0571	32	1·2758	56	1·6087
9	1·0647	33	1.2869	57	1.6263
10	1·0725	34	1·2982	58	1·6444
11	1·0802	35	1·3097	59	1·6629
12	1.0882	36	1·3214	60	1·6818
13	1·0963	37	1·3333	61	1·7011
14	1·1044	38	1·3454	62	1·7209
15	1·1128	39	1·3578	63	1·7412
16	1·1212	40	1·3703	64	1·7629
17	1·1297	41	1·3831	65	1·7831
18	1·1385	42	1·3962	66	1·8049
19	1·1472	43	1·4095	67	1·8271
20	1·1562	44	1·4230	68	1·8500
21	1·1653	45	1·4369		
22	1·1746	46	1·4519		
23	1·1840	47	1·4654		
24	1·1935	48	1.4800		

NOTE ON A SAMPLE OF ADULTERATED ASSAFŒTIDA.

By John Muter, Ph.D., F.C.S.

At the last meeting of the Society of Public Analysts I exhibited and made some short remarks upon a specimen of adulterated assafœtida, which had been forwarded to me by a member of the Pharmaceutical Society, as having been sold to the firm with which he is connected. The article, outwardly, possessed a very excellent resemblance to the drug as met with in tears, having the usual odour and other physical properties, except that the tears were, perhaps, rather too perfectly rounded. When each tear was opened there was to be seen a piece of stone snugly ensconced in the centre of it. Taking the average of three tears I found by weight—

Assafœtida	21·23
Stone	78·77
	100·00

The stone employed was a species of magnesian lime stone, as shown by the following analysis of it made by one of my advanced students, Mr. Orestes Pisani, M.P.S., after igniting off the assafœtida:—

Calcium carbonate	51·50
Magnesium carbonate	39·90
Siliceous matter	7·00
Iron and alumina	1·60
	100·00

There appears to be very little doubt but that the fabrication of the article has been most deliberately carried out, as the stones were all of nearly the same size, and carefully chipped to a suitable shape for resembling tears after receiving a coating of the gum-resin. That the stones had been covered by melting the assafœtida, and then dropping them into the liquid until they had taken up a sufficient coating, was rendered probable by the fact that, although the coating smelt fairly, it yet contained far too little of the volatile oil of the drug. In conclusion, it would seem advisable that pharmacists, having tear assafœtida in stock, should examine the same by cutting open a few of the more rounded fragments, as I have heard of the discovery of this adulterated article from more than one source lately, and anyone, innocently selling it, might be placed in an awkward position.

DETECTION OF WATER IN ALCOHOL AND ETHER.

ON evaporating a mixture of solutions of two parts of citric and one of molybdic acids, heating the resulting mass to incipient fusion, dissolving in from 30 to 40 parts of water, saturating strips of filter paper with the solution, and drying the same at 100°, a blue paper is obtained, which is bleached by water, and which may be employed as an indicator of the same in alcohol, ether, &c. *(Chemiker Zeitung, 1880, p. 307.)*—O.H.

ON THE SAPONIFICATION OF FATS.

FOR the saponification of fats there are frequently employed, instead of soda or potash, a number of basic oxydes, and it is commonly supposed that the result in such cases is practically the same, a soap or plaster resulting with the separation of glycerin. Very frequently oxyde of lead is the saponifying agent, the fat to be examined being thoroughly well mixed with its double weight of oxyde of lead and water, the mass heated to 90—100°C. with frequent agitation, the saponified product well washed with hot water, which, after filtration and evaporation, leaves the glycerin, which may be purified by treatment with alcohol. The insoluble lead soaps are dried, agitated with ether for the solution of the oleate of lead, whilst the stearate and palmitate remain undissolved.

Von der Becke, in making a comparative examination of the processes of saponification by oxyde of lead, by potash in alcoholic solution, and by lime, arrived at the following remarkable results:—

Cocoa butter and tallow gave only traces of glycerin on saponification by oxyde of lead (0·23 and 0·18 per cent. respectively); with lime they yielded 2·19 and 2·48 per cent., and with potass 5·99 and 7·84. Butter fat gave, with PbO 7·98, with CaO 7·99, and with KHO 10·59. Lard, by the same agents, in a similar order, 6·60, 8·27, and 9·27 per cent.; olive oil, with PbO 8·76, with KHO 6·41; rapeseed oil, 4·20 and 4·58; linseed oil, 4·40 and 6·20.

The various oxydes exhibited therefore a widely different behaviour with the several fatty matters.

A mixture of cocoa butter and tallow was likewise hardly attacked by PbO, whilst, curiously, a mixture of butter and cocoa butter gave, with the same oxyde, the full proportion of glycerin, 8·05 per cent.

Previous treatment with very dilute sulphuric acid at 150° C. renders both tallow and cocoa fat more readily amenable to decomposition with PbO.

If further investigation should prove the statements of Von der Becke to be correct, they might possibly furnish the means for solution of one of the most difficult and urgent of analytical problems, viz., the discrimination of the various fatty oils from, and detection of admixture with, each other. *(Zeitschr. f. Anal. Chem., 1880, p. 291).*—O.H.

ON THE ESTIMATION OF PHOSPHORIC ACID, BY ALFRED SMETHAM, F.C.S., &c.

A Reply by E. F. Teschemacher and J. Denham Smith.

By the courtesy of Mr. Smetham we are in possession of his paper bearing the above-named title, and by the permission of the Editor of The Analyst, we take leave to remark upon some of the statements made therein.

The only difficulty of dealing with this pamphlet is that of knowing where to begin, as it bristles with misdescriptions, misdirections, misstatements, and mistakes. However, to follow the good rule of beginning at the beginning, the very title is a misdescription. When Mr. Square spoke of the Christian religion he was careful to define what he meant by the term. Mr. Smetham, when addressing his listeners upon one of the most widely extended subjects in analysis, omits to define what he means by "Estimation of Phosphoric Acid," which (from the paper) proves to be a very few experiments on two points only of a very limited division of his subject, together with a single experiment which has nothing to do with it. Whether this absence of, as it seems to us, requisite words in Mr. Smetham's paper is due to an absolute dislike of them, like M. Gambetta's dislike of the Jesuits, to a love of brevity, forgetful that brevity may lead to obscurity as well as to wit, or a failure to discern that, in print, at any rate, words, and also properly chosen words, are essential to an author who has a meaning to convey, and who would take pains to make that meaning clear, we cannot judge; but we fear the last must be the true reason for this failure, from his carelessness at times in their use, as we shall presently show. Our eye had not travelled down more than three or four lines of this thesis before it fell on one of these instances of carelessness and misdescription, wherein this author states that, "we issued, during the past year, a pamphlet on 'The Estimation of Phosphoric Acid.'" Now as our memory told us that this was a mistake, we looked up a copy, and there we find the title of our pamphlet to be, "On the Estimation of Phosphoric Acid, *by Magnesia, for Commercial Purposes,*" *&c.* We had limited our researches, and had, of set purpose, been careful to describe our limits in the two clauses we have italicized, of Estimating Phosphoric Acid by "*Magnesia,*" and "*for Commercial Purposes.*"

In this our object is made manifest, and we deny the competence of anyone so to dock our title as to convey to a reader or hearer a meaning of the widest kind, when we had described in so many words the exact limits to which we had confined ourselves. In his very next sentence we find it stated, "By these experiments they came to the conclusion, which had been previously arrived at by other chemists, that this salt—ammonia-magnesic phosphate—*is totally insoluble* in water containing one-eighth of its bulk of ·880 ammonia." The italics are ours.

This is too bad. We came to no such conclusion: indeed we stated that "eight *filtrates yielded 0·25* grain of pyrophosphate, an average of 0·03 grains dissolved in wash-waters;" and further, "when we maintain its insolubility, we mean its practical insolubility," not one word of *total insolubility* when discussing the absurdity of adding some 2 per cent. to the weight of pyrophosphate, which we characterized, and still characterize, as "a vamping up by ridiculous allowances," despite this author's recommendation to revert to this silly practice. As to the "other chemists, who had previously arrived at the total insolubility of this salt in ammonia-water," Mr. Smetham does not cite any one of the gentlemen who found this mare's nest, and who, if they exist in the flesh, have been wisely reticent of their discovery. He then notices the "high solubility" of this salt which was found by Fresenius, a strange and surely unfit term to apply to a salt of very slight solubility, but serving to illustrate this gentleman's vocabulary, and assures us of his belief that Dr. Fresenius "has since found occasion to modify this opinion," a belief which may or may not be well founded, as we are as little acquainted with the conclusions of Dr. Fresenius as this chemist is with ours. Nevertheless, he tells us that our "conclusions seemed to him to be at variance with what he should expect," when he could have made sure that there is no seeming nor guessing about our statements, and proceeds to say that our "experiments were conducted in a very crude manner." Why "very crude?" We have referred to our pamphlet, and finding them to be numerous, direct, and to the point, are curious to know wherein these experiments are "very crude." Mr. Smetham can employ terms in depreciation, but he cannot quote fairly.

He then tells us: "I started the following set of experiments in the hope of setting the matter at rest." This "set of experiments," we find, amounts to three. The first yields incorrect results, viz., "·0064 grammes of pyrophosphate in excess of the theoretical quantity, due, probably, to the fact that the phosphate had effloresced. This, however, is immaterial." So "probably," "immaterial," and the like, are fitting epithets for an experiment which is to "set the matter at rest." Would not "crude" in the sense of raw, rude, incomplete, apply here, especially as in describing these experiments, made to determine the solubility of the salt in question, this chemist nowhere states the quantities of the wash-water used?

The chemist is now rewarded for his pains; he finds the filtrates yield him ·0020, ·0060 and ·0160 grm., or, as it pleases him to write, "grammes," respectively, of pyrophosphate of magnesia, and sagely remarks, "From these experiments it is evident that ammonio-magnesic phosphate is perceptibly soluble in ammonia water." Indeed! But then, who ever doubted it? Not Dr. Fresenius; not Teschemacher and Smith, as our critic calls us. So far as our memory serves us, we have heard of none, excepting the band of "chemists who had previously arrived at the conclusion that this salt is totally insoluble in water containing one-eighth of its bulk of ·880 ammonia," known to and vouched for by Mr. Smetham; who then instructs us that should we rely on—we think he means Dr. Fresenius—we must add one milligramme of pyrophosphate for every 54 c.c. of solution; but should we prefer Mr. Smetham, then, for 54 c.c., we must substitute 100 c.c., 84 c.c., or 62 c.c., respectively, thus allowing us the privilege of choice as our wishes or inclinations may prompt between 62 and 100 in respect to these three experiments, which are to "set the matter at rest," when vamping up an analysis in the modern style. In the next paragraph we find "Teschemacher and Smith's statement, that no allowance should be made for the solubility is far from conclusive." May we be permitted to inform this writer that misrepresentation is not criticism. We said nothing of the kind. What we did say, and what we say again, is, "That we should reject as worthless any process which permits of an error of 2 per cent."

In six more experiments Mr. Smetham disposes of the influences of citric acid, iron, and alumina on the solubility of the ammonia-magnesian phosphate, which may be investigated by the curious; then passes to the correction he thinks fit for the solubility of this salt, which he fixes at 0·18 per cent. of phosphoric acid; and, finally, "sketches the method he pursues," which he has "always found to give excellent results." If by "excellent" he means accurate, and he further means—which to us seems the only inference—that he is speaking of commercial samples of rock phosphate, we can but own to a disappointment somewhat akin to humiliation that a work of ours, which we maintain bears intrinsic evidence of much thoughtfulness and care, could, even in the case of a single reader, prove so utterly futile. His method is the method we published, but so altered by the omission of well-nigh every precaution we insisted on as requisite to ensure success, that it needs a parent to recognize the changeling. In page after page did we insist on the prime necessity of the most careful attention to *moisture*, showing by repeated instances the necessary fallacy of all results unless the moisture of a sample was carefully determined; and closing our reiterated caution on this point by saying that "our pains would be wasted and our chief aim thwarted unless we could set this matter of *moisture* to rights." Mr. Smetham must have had our monograph in his hand—probably he has read it, but most certainly not with the understanding; for the moisture is never once mentioned in the details of the method, of which he says "I have always found it give excellent results;" a statement which carries with it its own contradiction, as the neglect of this question of moisture necessarily vitiates the results of every analysis made by Mr. Smetham.

A SIMPLE PLAN FOR RAPIDLY AND SAFELY DRYING A SPECIFIC GRAVITY BOTTLE OR FLASK.

By J. Shea, M.D.

It not unfrequently occurs that a clean, *dry* sp. gr. bottle or flask is wanted for use, and in hurried drying sometimes get cracked. The following little device has been found useful:—

Wash the bottle or flask with distilled water and drain it for a moment or two. Then wash with a little strong alcohol and drain the bottle a second time. The alcohol need not be wasted, as it is but slighted diluted with the residual water from the first washing. When the bottle is again drained it remains wet with the diluted alcohol. Pour in a little dry ether and wash the bottle out with this. Again drain, and the warmth of the hand or very little extra heat will then completely dry the bottle or flask. The alcohol must of course be *strong*, and the ether *dry*, or the device fails.

ON THE ACTION OF WATER UPON MERCURIC SULPHATE.

By Charles A. Cameron, M.D., F.R.C.S.I.

In Berselius' *Treatise on Chemistry*—and in all its editions in German and French—it is stated that the action of water upon mercuric sulphate resolves it into an insoluble subsalt, and an acid soluble salt. The latter, it is stated, may be obtained by evaporating its solution until crystals begin to form. These crystals are described as white needles, which attract moisture from the air, and are precipitated out of solution on the addition of concentrated acid. These statements in reference to the action of water upon neutral mercuric sulphate appear to have been copied into most works on chemistry of later date. In Fownes' *Manual of Chemistry*, 12th Ed., 1877, page 424, it is stated that water decomposes the (mercuric) sulphate, dissolving out an acid salt and leaving an insoluble yellow basic compound, formerly called *turpith*, or turbeth mineral, containing, according to Kane's analysis, $HgSO_4$, $2HgO$, or $3HgO$, SO_3. In Brande and Taylor's, Tidy's, and other modern works on chemistry, reference is made to a soluble acid—mercuric sulphate. In Watts' *Dictionary of Chemistry* the formula HgO, $35O_3$, is assigned to this salt. This statement assumes that the action of water upon neutral mercuric sulphate is to resolve it into trimercuric sulphate and mercuric trisulphate:—

$$4\ HgSO4 = HgSO_4 = (Hg^o)_2 + HgSO_4\ (SO_3)_2.$$

The formula assigned to the acid mercuric sulphate is a very unusual one. The salt is stated in Watts' *Dictionary* to be procurable by evaporating the liquid which remains when the basic salt produced by the action of water upon mercuric sulphate is separated. The results of my experiments show that an acid salt cannot be obtained in this manner.

Experiments.—Neutral mercuric sulphate was treated with water. The basic salt thereby formed was separated from the liquid by filtration and the liquid evaporated until a pellicle made its appearance upon its surface. A mass of crystals was obtained in this way, which were freed from adhering liquid and dried at 100° Cent. These crystals should, according to Watts' *Dictionary*, have the formula $HgSO_4(SO_3)_2$. On treating them with water they changed from a white to a yellow colour, and produced the basic salt. On being analysed the crystals proved to be wholly composed of the neutral sulphate $HgSO_4$.

A further quantity of neutral sulphate was decomposed by water, the proportion of water used being in the ratio of two molecules to four molecules of the sulphate. The basic salt having been separated from the liquid, the latter was allowed to evaporate spontaneously *in vacuo* over sulphuric acid. The crystals obtained in this way were placed upon a tile and allowed to drain during two days. They were pressed between sheets of bibulous paper, washed with bisulphide of carbon, dried, and analysed. They proved to be crystals of the neutral sulphate. Neutral mercuric sulphate was dissolved in dilute sulphuric acid, and the mixture allowed to evaporate spontaneously *in vacuo*. The crystals which formed consisted of simply neutral mercuric sulphate.

The action of water upon mercuric sulphate produces a basic salt and free sulphuric acid—$3HgSO_4 + 2H_2O = HgSO_4\ (HgO)_2 + 2H_2SO_4$. The free acid dissolves some mercuric sulphate, but no acid salt appears to exist—at least, it cannot be got out of solution. The last crystals that form spontaneously out of the most acid solution are simply composed of the neutral sulphate. When a large quantity of water is employed in decomposing mercuric sulphate, no mercury, or a mere trace, is to be found in the liquid when separated from the basic salt. On the other hand, more mercury remains in solution when three molecules of water are used in decomposing the neutral salt than when two—the theoretical amount—are employed. The neutral sulphate is more soluble in slightly diluted sulphuric acid than in the strong acid; but it is not sensibly soluble in very dilute acid.

It may be worth noting here that when basic mercuric sulphate is dissolved in selenic acid, and the mixture allowed to evaporate spontaneously, neutral mercuric sulphate makes its appearance; but when, on the contrary, basic mercuric selenate $HgSeO_4 (HgO)_2$ is dissolved in sulphuric acid, and the solution allowed to evaporate spontaneously *in vacuo*, neutral mercuric sulphate crystallizes out. It is stated in the books that the crystals formed by evaporating an acid solution of mercuric sulphate attract moisture from the air. This statement is incorrect. The crystals, when freed from excess of acid, are permanent in the air. It is stated that one part of basic mercuric sulphate dissolves in 3,000 parts of cold water. I find that a litre of water at 16° Cent. (60·8 Fahr.) dissolves 0·023 millegrammes of the salt, and at 100° C.; that is, 2·3 parts of the salt are soluble in 100,000 parts of water. The freshly precipitated salt, free from excess of acid, dissolves in time its weight of water at 16° C.

The only acid mercury salt described in the books are the salt which I have shown not to be really an acid one, and an acid selenite of mercury, which I have some reason to conclude has no real existence. The tendency of neutral mercury salts is to combine with alkaline bodies, and not with acids.

Basic mercuric sulphate dried at 100 C. dissolves to the extent of 0·023 gramme in a litre of water at 16° C. = 1 part of the salt in 43,478 parts of water. The salt, when freshly precipitated, dissolves to the extent of 0·031 gramme per litre of water = 1 part in 32,258 parts of water. The much greater solubility ascribed to this salt is evidently an error due to the determination of the solubility of a specimen containing free acid.

EXAMINATION OF DEPOSIT IN COMMERCIAL DILUTED PHOSPHORIC ACID.

By P. C. Jensen, Ph.C.

During the last six months I have been particularly interested in regard to a peculiar organized deposit, existing in a number of specimens of acid. phosph. dil. of commercial grades which have come under my observation.

If this diluted acid is made, either by burning phosphorus in air or oxygen, resulting first in the production of phosphoric anhydride (P_2O_5), which is afterwards dissolved in water, or by the process of the Pharmacopœia—namely, the action of nitric acid upon phosphorus—the resulting product is not likely to be contaminated with foreign substances or the germs of organic matter.

On the other hand, if this acid is made by dissolving glacial phosphoric acid in water, as prescribed or directed by some formulas yet in use among certain manufacturers on Continental Europe, or by the alternative process in the present U.S. Pharm., there is reason for the introduction of such matters.

Glacial phosphoric acid is made from bones, by a roundabout process, which is very apt to result in an impure product. It is to these conditions in its manufacture that I attribute the cause of the organized deposit in the diluted acid.

This deposit, like all fungous deposits, will increase by exposure to the atmosphere, with but very slight increase when air is completely excluded.

Chemical Behaviour of the Deposit.—1st. To a small portion of the deposit I added concentrated sulphuric acid; the substance turned black (charred), evidence of organic matter.

2nd. To a small portion of the deposit I added hydrochloric acid and potassic chlorate until the organic matter was oxidized, or broken up, as shown by the change of the solution from green to yellowish, constantly keeping up the measure by addition of water with constant stirring on a water bath at a temperature of 60° C., until sufficiently concentrated, and until chlorine was expelled. I then added ammonic carbonate, which produced a white precipitate. Another portion I treated with a solution of ammonic oxalate, producing calcic oxalate, insoluble in acetic acid, but soluble in hydrochloric acid—evidence of calcium.

I was unable to obtain any magnesium salt in the deposit, but I found a trace of hydrochloric acid; no silicate was present.

3rd. The clear supernatant liquid of acid. phosph. dil., by addition of ammonic hydrate and ammonic carbonate, formed a white precipitate, which redissolved in acetic acid with effervescence. Then, on addition of ammonic oxalate, white calcic oxalate formed, insoluble in acetic, but soluble in hydrochloric acid. This furnishes conclusive evidence of lime both in the supernatant liquid and in the deposit.

Microscopical Examination of the Deposit.—For microscopical examination I employed a magnifying power of 75 diameters, being unable to use the high power with equal accuracy. The minutest quantity under the low power represents a fibrous network very analagous in appearance to the Tela Contexta, as found in the mosses, anastomosing and exhibiting very well-defined oblong muriform cells placed end to end. In the interstices of its central ramifications are seen small bodies resembling nuclei. These nuclei are nearly double the size of the diverging fibres constituting the mass of the deposit. The colour of the deposit is of a greyish white, with diffusive and elastic properties.—*New Remedies.*

THE MANUFACTURE OF ALUMINIUM, SODIUM, AND SIMILAR METALS.

A PATENT has been obtained by Mr. W. P. Thompson, of Tranmere, for a novel process of manufacture of aluminium, sodium, and similar metals, which, if successful, would very greatly reduce the present high price of these metals. Liquid iron, either alone or in conjunction with hydrogen or carbon is to be the reducing agent, and the operation is to be conducted in an apparatus similar to the well-known Bessemer converter. This apparatus is made up of two characters. After the iron has been fused in the one it is transferred into the second by turning the converter. Through a tube opening into this second chamber, hydrogen, or carburetted hydrogen is allowed to enter, and through another one chloride or fluoride of aluminium in a state of fusion or as gas. Hydrogen and ferric chloride escape, and in the converter remains iron alloyed with aluminium and carbon. This mixture is then again transferred to No. 1 chamber, where the carbon is to be burnt by a current of air. After retransferring to No. 2 the process of reduction is to be continued, until the iron is almost wholly consumed, when hydrogen alone is to be used as reducing agent. Thus an iron-aluminium alloy results.

For the preparation of sodium, hydrogen is not requisite. Iron, mixed with much carbon, is to be heated with caustic soda in the converter, and the sodium, said to be formed under these circumstances, is simply distilled off. When all carbon is consumed the iron may be worked into Bessemer steel or may be again re-carbonised.

Iron and potassium not forming an alloy the method is not well applicable for the preparation of potassium.

For the manufacture of pure aluminium, sodium is to be preferred in the manner described, and then in the chamber containing the metal, chloride or fluoride of aluminium is to be allowed to enter, air being excluded. The chamber is provided with stirring gear, and is lined with alumina, or a mixture of lime, magnesia and alumina.

The inventor will likewise apply his process to the preparation of magnesium, calcium, strontium and barium. (Patent 2101, March 27, 1879).

ADULTERATED DRUGS.

At the recent meeting of the Grand Jury of the County of Monaghan, Dr. C. A. Cameron, County Analyst, reported that amongst the articles analysed by him nine were drugs supplied to one of the Unions, and not one of which was pure. Sulphate of quinine, so called, did not contain a particle of that drug, but was composed wholly of sulphate of cinchonine. The "tincture" of perchloride of iron contained no spirit; aromatic sulphuric acid contained no bark; compound tincture of bark was deficient in extract, and did not contain all the ingredients which the Pharmacopœia directs. All the tinctures were deficient in spirit of wine. Etherial tincture of lobelia was made with methylated ether.

ANALYSTS' REPORTS.

Mr. J. Carter Bell, the analyst for Cheshire, reported that during the quarter ending June 30, he had analysed 212 samples. Of these 33 were adulterated, namely, 8 milks, 5 coffees, 6 mustards, 5 spirits, 7 oatcakes, 1 bread, and 1 butter. The oatcakes were adulterated with chalk, in some cases as much as 10 per cent. The report proceeded :—"I consider the use of chalk in food most injurious, for a person, making a hearty meal of oatcake, would take two ounces of chalk, which would seriously impair the digestive organs. Five samples of water were highly contaminated with sewage and vegetable matter, and were not fit for domestic consumption."

Mr. J. Carter Bell, Public Analyst for the Borough of Salford, in his report for the quarter ending June 30, stated that in that period he had analysed 124 samples. Of these 15 were adulterated, namely 3 of beer, 2 of mustard, 7 of butter, and 3 of milk. The adulteration was rather below the average during the quarter, the average of adulteration for the year 1879 being 19. The report continued :—"No Corporation in the kingdom pays such attention to the Adulteration Act as the Corporation of Salford. In some places the Act is a mere farce, for few, if any, samples are collected for analysis, and the consequences are that 'vitriol madness,' alumed bread, and milk and water are sold to the poor without let or hindrance. Such a state of things is almost unknown in Salford, owing to the energetic measures taken by the health committee in repressing adulteration." Salford stood far above all other boroughs in the kingdom as regarded the number of samples analysed, and in no borough was the Adulteration Act worked at a less expense in proportion to the work done than it was in Salford.

Mr. E. W. T. Jones, Public Analyst for the County of Stafford, in his report for the quarter ending last June, states that he examined 216 samples, of which 37 were adulterated, viz., 16 butter, 6 coffee—4 containing as much as 56, 57, 61, and 71 per cent. of chicory, 1 gin, 1 ground ginger—containing wheat flour coloured with turmeric, 8 milks, 4 mustards—containing wheat flour and turmeric, and 1 ale.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

RUGBY MILK.

To the Editor of "The Analyst."

Sir,—I had this week a sample of milk to analyse, which was supplied to one of the boarding houses. It contained—

Total solids	5·921	
Fat	*nil.*	
Ash	0·258	
	——	S.G. 1006

The milk was very sour, and quite curdled. On standing, the curd settled down, leaving a clear supernatant liquid. Under the microscope, swarms of bacteria were detected.

I am unable to say if the acidity of the milk is accidental (from dirty can, &c.) or not.

I am happy to say that all the Rugby Milks are not as bad as the above, but they seem to be sophisticated.

The following analyses I made about a year ago:—

	Weight of 100 c.c. grms.	Total Solids.	Fat.	Solids not fat.	Ash.	
1	101·5	10·038	0·935	9·103	·49	Same source.
2	102·3	10·1025	·645	9·457	—	
3	102·3	9·579	·684	8·995	·557	
4	102·2	12·778	1·780	10·998	—	Same source.
5	102·5	13·317	3·263	10·057	·673	
6	102·6	10·809	1·676	9·133	·528	
7	102.2	10·176	1·497	8·679	·322	
8	102·2	11·252	1·604	9·648	·596	
9	101·9	10·098	2·031	8·067	·529	
10	102·9	14·868	1·749	13·119	—	
11	101·8	14·74	3·57	10·17	·658	

No. 5 I got from the can as the milkman was taking it home from the farm.

No. 4 is the same milk when sold in the town.

No. 10 is acknowledged skimmed milk from a farmer, and is better than some sold as fresh.

No. 11 is the milk supplied me by the vendor of Nos. 4 and 5.

I am, &c.,
A. PERCY SMITH.

LAW REPORTS.

Analyst's Certificate as to Milk must state that no change has taken place in the Sample to interfere with the Analysis :—

Adulterated Milk.—Robert Jackson was summoned by the police for selling milk adulterated with water at Old Sleaford. Mr. Jessopp appeared for defendant. Supt. Stevenitt deposed that on the 27th of May he purchased a quart of milk of defendant's wife, for which he paid 4d., and conveyed the same the next day to Dr. Graham, of London, whose certificate he then produced, which showed that the milk consisted of one-tenth of water. Mr. Jessopp for the defence, observed that he should before proceeding to answer the charge, raise a technical objection with reference to the words used by the Superintendent when purchasing the milk. According to the Act any person purchasing an article for analysis, must notify to the seller or his agent his intention of having the same analysed by the Public Analyst. The Inspector must, according to the Act, make use of the words "Public Analyst." Mr. Jessopp quoted an appeal case in the Exchequer Division, "Barnes *v.* Clipps," which was dismissed owing to the omission of the words "Public Analyst," by the inspector who purchased the article. Supt. Stevenitt recalled, stated that when he first bought the milk he told Mrs. Jackson it was for analysis; he asked her to divide it, and upon meeting with a refusal he said he should take it to the County Analyst who would divide it; he said County not Public. This objection was over-ruled, the Bench considering that County Analyst was sufficient. Mr Jessopp remarked that he had a further technical objection to raise with reference to the wording of the certificate. According to Stone's Justice's Manual, in the case of milk it must be specially stated by the analyst whether any change has taken place to interfere with analysis, and unless such statement were made the certificate did not conform with the Act. It was also shown that the analyst's certificate must be taken as *prima facie* evidence to save the expense and trouble of the analyst being present to prove the case. The Chairman observed that having taken their Clerk's opinion and duly considered the circumstances, it appeared that the analyst's certificate was not made out in conformity with the Act and they should therefore dismiss the case.

Sweet Spirits of Nitre :—

At the Stockport Borough Court House, on 17th July, Henry Charles Bennett was charged with selling, to the prejudice of Jacob Marshall, on the 3rd inst., a certain quantity of sweet spirits of nitre, the same not being of the nature, substance, and quality demanded by the purchaser. The Town Clerk prosecuted on behalf of the Sanitary Committee of Stockport; Mr. Glaisyer, of Birmingham, appearing for the defence. Jacob Marshall, inspector of nuisances, said that on the 3rd July, he went to the defendant's shop and asked him for 4 oz. of sweet spirits of nitre. He paid 1s. 4d. for it, and then told the defendant that it was to be analysed by the Public Analyst, and divided it into three parts. One bottle was sent to the analyst, and afterwards his certificate was received and was to the following effect :—That instead of containing three per cent. of nitrous æther, the sample only contained 1·15 per cent., and that the specific gravity was ·844 instead of ·855. Mr. Oswald Wilkinson, Borough Analyst, was then called. He said he received a sample of sweet spirits of nitre similar to the one which had been produced in court, marked B. No. 2, from Inspector Marshall. He analysed it, and afterwards delivered a certificate to the inspector personally. He said the sample only contained 1·15 of nitrous æther. The British Pharmacopœia gave three per cent. as a fair standard of the quality of the article. He did not consider that a person asking for sweet spirits of nitre received what he desired when he only got an article containing 1·15 of nitrous æther. Sweet spirits of nitre was the same article that was mentioned in the British Pharmacopœia. Dr. Downs : What name had this formerly? Witness said that as far as he could remember, it had been known as sweet spirits of nitre or spirits of nitrous æther. He tested it by specific gravity. He did not use the tests recommended by the British Pharmacopœia, but those of Dupré. He tested it for the colour to the extent of five minutes. He had never made an experiment on an article containing pure nitrous æther. Here, at the request of the solicitor for the defence, witness described minutely the tests ordered by Dupré. He said he believed the nitrous æther to be the active medicinal principle. At once he would say the purchaser was prejudiced in receiving the article which the defendant had sold. To the best of his ability it was the nitrous æther that did the good for which the medicine was taken. He should think there was something present besides nitrous æther. Sweet spirits of nitre was the common name for spiritus ætheris nitrosi. Dr. Edwin Rayner, medical officer of health for the borough of Stockport, said that the article ought to contain more than two per cent. of nitrous æther. He had himself analysed specimens some years ago. It was a very common medicine, and was used very extensively by the people. It possessed certain properties which rendered it good for certain diseases. These properties were known, and the medicine was used by the public accordingly. The absence of nitrous æther would decrease the medicinal value of the drug. Cross-examined : The sample in question was not a good one, because it contained less than two per cent. Mr. Glaisyer having opened the case for the defence, Henry Charles Bennett said he was the defendant, and was a chemist and druggist in business in this town. He recollected the inspector coming on the 3rd June and asking for four ounces of sweet spirits of nitre, and paid 1s. 4d. He served him with the article commonly sold as sweet spirits of nitre. That article was in constant request by the public. He had supplied the British Pharmacopœia preparation, and he constantly had it brought back. He had complaints in every case about it, about its unpleasant smell, burning their throats, and the colour. He purchased the article he sold from Messrs. Evans, Son, and Co., Liverpool, in May. He supplied it to the inspector in the same condition as he received it. He kept both preparations in his shop. He had been in Stockport about three years. The difference in price was 4d. per pound between the two. The wholesale prices were 3s and 3s. 4d. One was sweeter than the other, and that was why they took it. He did not think that the sweet spirits of nitre was an inferior quality to the British Pharmacopœia. By Mr. Glaisyer : The reason for selling ·850 was that the customers would not have the other. He had not recently attempted to supply it. Professor Attfield said there were two distinct varieties of sweet spirits of nitre in this country ; some other varieties were imported. There were varieties in all countries on the continent, and that was perfectly well known. The materials used in these two varieties were quite distinct. The variety of the British Pharmacopœia is made from spirits of wine, nitric acid, copper, and sulphuric acid. The latter variety is made with the materials mentioned in the Pharmacopœia of 1809, 1836, and 1851. In the 1863 Pharmacopœia the ingredients are the same. The processes were practically the same. In this particular case he received a sealed sample on the 5th July. He analysed the contents of the bottle, and compared it with samples of perfect purity, made by himself, and it was quite as good as them. It was, in his opinion, a good sample of sweet spirit of nitre. It was as good in appearance and odour, and answered as well to the tests and specific gravity. The specific gravity is ·850. He considered that the analyst had obtained figures which were too low, and that he did so because the temperature that he observed was too high. The temperature he should have observed is 60 degrees, whereas he stated that he worked at 64½° Fahrenheit. In the Pharmacopœia these ingredients were ordered to be taken at 60 degrees, and that would partly account for the difference. He considered that he worked on too small a quantity. By Mr. Glaisyer : As regards the percentage of nitrous æther, no one knew what that percentage should be. The analyst found 1·15 of nitrous æther. He placed not the slightest reliance on any point by which the analyst got at 1·15 per cent. There might have been more or less. The process was wholly untrustworthy. He said that medical authorities could not agree as to the exact substance.

The benefit as a medicine might be due to nitrous æther or to ældhyde; it may be due to other ethereal bodies. It might be due to union of those substances. On this point medical authorities are not agreed. Michael Conroy said he was manager for Messrs. Evans, Son & Co., Liverpool. They were manufacturers of drugs and other medicines. They supplied the defendant with the sweet spirits of nitre in May last. The specific gravity was ·850. The new variety was dearer than the old, therefore it would be to their advantage to push the sale of the new. They sold about 3 gallons per week, whereas of the old they regularly sold from 120 to 150 gallons per week. The magistrates then retired, and after a brief consultation returned into court, when they said that they thought the evidence was in favour of the defendant, and therefore the case would be dismissed. Mr. Glaisyer then asked the bench for costs. They replied that they must consider the other side as well, but they had been thinking of that a while ago, and £10 would be allowed, but this was not to be taken as a precedent in any future cases.

Sunday Samples.—Salt in Milk :—

At Woolwich several points of public interest arose during the investigation of certain adulteration cases consequent on a Sunday collection of milk samples by the Woolwich Local Board of Health. In the case of John Chard and Joseph Brandon, the samples were found to be adulterated with 26 per cent. of added water and 100 grains of salt per gallon, and the blame was in both instances attributed to a man in the employ of the wholesale dealer, who was said to have admitted his guilt. The magistrate, Mr. Marsham, asked for what purpose the salt was introduced, and Mr. Hughes, the Local Board solicitor, said it might be to preserve the milk, but it was probably to increase the specific gravity and prevent the presence of water being detected in the lactometer. The Board's inspector said he had been informed by cowkeepers that the salt would give a "body" to weak milk and prevent the water from being discovered. Mr. Hamilton, the farmer by whom the milk was originally supplied, expressed a desire to take criminal proceedings against his agent for adulterating the milk and thereby damaging the trade, adding that he had such an abundance of milk that he hardly knew what to do with it. Mr. Marsham said it was a common complaint among milk sellers that they could not get a warranty from the wholesale dealers, and Mr. Hamilton replied that he was always ready to give a warranty if required. Mr. Hughes expressed a desire to have the agent present to answer the allegations made against him, and the cases were accordingly adjourned. The analyst's certificate in the case of James W. Headman, another milkman, showed an adulteration of 10 per cent. of added water, but the defendant declared that the milk only passed through the hands of himself and son, and was as pure as it could possibly be. All milk, he said, contained some water, that from cows in the shed more than from cows at grass. Mr. Hughes informed the magistrate that the analyst allowed 10 per cent. of water as a proper constituent of milk. The defendant repeated that his milk was pure, and requested that the analyst or his inspector would come to his shed, milk a cow himself, and then examine the sample and experiment, for which he offered to pay the expenses. Mr. Hughes said it was a fair challenge, and it was arranged that the inspector should take a sample direct from the cow and send it for analysis in the usual way, the defendant to pay one guinea expenses. For this purpose the case was adjourned for a fortnight.—*Times.*

Employer Fined for Addition of Water to Milk by his Servant :—

At Marylebone Police Court, Mr. Herbert Dodwell, farmer, of Lob Farm, Tetsworth, Oxfordshire, was summoned for selling milk found on analysis to be adulterated. The defendant has recently entered into a contract to supply the Royal Shorthorn Dairy Company, of Bridge Terrace, Paddington, with milk, and had formerly supplied the Express Milk Company for eight years. In consequence of an application made by the manager of the former company to the Inspector, he attended at Paddington Station on the arrival of three churns from the defendant, put seals on them, and gave notice of his intention to defendant to take samples. He did so in the presence of defendant, and had them analysed by the Public Analyst, whose certificates showed them to be adulterated with 18, 13, and 12 per cent. of added water respectively. Mr. Poland said the defendant was, by agreement with the Royal Shorthorn Dairy Company, under a forfeit of £20 on every occasion on which he should not supply pure milk to them. After careful inquiry they had found that a man employed by the defendant to cool the milk over the refrigerator, had added water to the milk, and on his being told that he would be called as a witness, he had admitted the offence. The defendant was exceedingly sorry, for the act of his man had made him liable to the law. The Rev. John Armstrong Coghlan, vicar of Tetsworth, and the Hon. Francis Parker, son of the defendant's landlord, both gave him a very excellent character; and Mr. George Barham, manager of the Express Dairy Company, said that during the eight years the defendant had supplied them with milk it had been invariably good. The magistrate said he was very glad indeed that these steps had been taken. So far as the defendant was concerned, he was willing to believe the defence was a genuine one, but the evidence showed that the defendant did not attend personally to his business, but left it a great deal to his servants. Fined 20s., and £3 3s. costs.

No Adulteration, if Substance added is not Injurious to Health, and does not Interfere with Weight or Measure of Article Sold:—

At the Bolton Borough Court, Peter Featherstone, farmer, Turton, was charged with selling milk not of the substance or quality demanded. Mr. Hick, of the Town's Clerk department, applied for a remand. Mr. Fielding objected to this. His client had been summoned to answer the charge that morning, and was ready to do so. The Mayor agreed with Mr. Fielding, but granted a remand for half-an-hour. On the case being again brought forward Mr. Hick stated that the offence was rather an aggravated one, for defendant had been previously convicted. The Mayor thought those remarks ought not to have been made at that stage in the case. William James, Inspector of Nuisances, said he purchased a pint of milk from defendant in Ashburner Street. He asked for it out of a particular kit in defendant's cart, but defendant refused to allow this. On asking the price he was told it was 2½d. per quart, so he paid 1½d. for the pint, and then told defendant he should have it analysed. It was then divided into three parts, of which defendant kept one, and another portion was taken to Dr. Sergeant. He was aware that the ordinary price of new milk was 3½d. per quart, and on telling defendant for what purpose the milk was obtained, was informed that it was night's and morning's milk, but defendant did not explain definitely what he meant by that remark. Richard Bullough, shopkeeper, Ashburner Street, said that defendant supplied him with milk, and he had been in danger of being convicted on account of the quality which defendant supplied. Witness did not confine his purchases to defendant, for there were two other milk dealers of whom he bought. The price paid to defendant was 3d. per quart. Dr. Sergeant proved receiving the sample of milk from the witness James, which, when analysed, was found to contain 20 per cent. of water and was further weakened by the abstraction of the cream. Mr. Hicks applied for the full penalty of £20, under section six of the Food and Drugs Act, for it was quite evident from Dr. Sergeant's report that the milk was not only skimmed milk but was largely adulterated with water. The Mayor said that when James, the Inspector, demanded milk of a particular kit, and then learned that it was night's and morning's milk he would understand that it was mixed milk. Mr. Hick did not think so. Even if it were so, it would only apply to the mixing of different sorts of milk. The charge was for mixing water with the milk. The Mayor said the Act did not regard it as adulteration if any substance was mixed with an article, which was not of itself injurious to health, and which did not interfere with the weight or measure of the article sold. If the Act had mentioned the quality of the article there might be a case, but in the present instance he thought there was none. The prosecution had failed to make it perfectly clear that the measure had been increased, or that the water added to the milk was injurious to health. Addressing Dr. Sergeant, his Worship asked if this was so, and receiving for answer that it could not be proved that it was, the Mayor asked if water could be said to be injurious to health? Dr. Sergeant said it depended on the circumstances. If water was taken where milk was wanted then it was. The Mayor: I did not ask that. I asked if water ordinarily was injurious. Dr. Sergeant said that he could not say that it was. The Mayor resuming, said the Bench had decided to dismiss the case, as they thought the charge had not been established. Mr. Hick then applied for leave to state a fresh case, which was granted.

NOTES OF THE MONTH.

We have received a letter from Mr. Kingzett on the subject of the review of his work on *Nature's Hygiene*, which we published last month. We do not at present print it, as we think that from its nature Mr. Kingzett himself would be, on reflection, one of the last to really desire its public appearance. We may say, however that our reviewer worked perfectly independently on his own convictions, with
parties, and that he did not review the work for

We observe from the *Cowkeeper and D*
lectures on milk analysis delivered to the
tion. The fee for these lectures is

Such lectures will, doubtless, be of great service by teaching the trade to take advantage of the low standard adopted at Somerset House, and showing them how, by regularly analysing their milk each morning, they may indulge in a remunerative amount of dilution without infringing that limit. The notice does not say who the lecturer is to be, but we presume that an eminent professor, who is already their own analyst, will officiate, as we observe from another part of the *Journal* that his fee for milk analysis is to be in future increased from 2s. to 3s. 6d. per sample. The Pharmaceutical Society's school has not of late been famed for full audiences, and on the principle that every little helps, the attraction of milkmen to Bloomsbury Square would not be a bad idea. How about *cramming*, however, which the professors there hold in such virtuous horror, for would not such demonstrations be a case of "cramming" on analysis of a very marked description.

It is curious to observe how little some analysts take advantage of the records of decisions printed regularly in our columns, and go blindly on in their old way. A very marked instance of this is seen in the report of a case of milk adulteration heard at Sleaford, which was dismissed on the ground that the certificate contained no statement as to whether the article was or was not in a fit condition for analysis. This point was raised and decided at the Wandsworth and Southwark Police Courts within six months after the passing of the Act; and had the analyst kept his eyes open and drawn the certificate as all his *confreres* have done for some years, the cases would not have been lost, and an unnecessary expense cast upon the authorities. One great object we have in view is, by our meetings and journal, to disseminate a knowledge of the decisions affecting the technical working of the Act, as well as to advance the science of food analysis, and analysts who neglect the opportunity of thus acquiring valuable practical hints have only themselves to blame when they suffer a check on a technical point.

According to Mr. Smith's letter in our correspondence columns, the Rugby boys are treated in the orthodox manner as far as milk is concerned, and the doctrine that strong meats are not suitable for babes and sucklings is rigorously adhered to in that classic seat of learning. It is to be feared that milk is, however, not always the staple fluid consumed by the modern Rugby boy, so perhaps its dilution does not so much matter.

The result of the Woolwich milkman's challenge to the analyst, reported elsewhere, proves that his guinea is lost, and that the natural milk of his cows proves to be above the Society's limits, and, therefore, above that of Somerset House.

Mr. Edge, a prominent member of the Manchester milk trade, has been indulging in some remarks against the analysts. He charges them with two perfectly new misdemeanours—at least, new to us. The first is, that the analysts never give the standard on which they b[illegible] pinion : [illegible] second, that they nett a considerable fee for each [illegible] on [illegible] of [illegible] tively assert that the Manchester analyst is not [illegible] is that if it be so (which we do not for a moment [illegible] certifying and terms of appointment from most [illegible] he issuing of a certificate for a milk found to be [illegible] fat, ash, &c., of the sample, is an unusual thing.

and we can assert in reply to Mr. Edge that, taken *en masse*, the analysts *do* give in every certificate the figures upon which they found their opinion, and that no analyst receives any fees depending on the number or success of the prosecutions for which his certificates are employed. Mr. Edge and his friends would make more converts to their way of thinking if they held to the exact truth, and did not make general charges against a body of men founded on wrong premises. If Mr. Edge can for a moment prove his assertions, then we will grant him space to do so; if not, he must in future abstain from such reckless statements regarding us.

At a recent meeting of the Bristol Town Council, Mr. F. W. Stoddart was appointed Public Analyst, in the place of his father, the late Mr. W. W. Stoddart.

Mr. J. Comyns Leach has been appointed Public Analyst for Blandford.

Mr. J. Pattinson has been appointed Public Analyst for Gateshead in the place of the late Mr. A. J. Edger.

Mr. W. F. Stock has been appointed Public Analyst for the County of Durham, also in place of Mr. Edger.

Dr. W. Morgan and Mr. J. W. Thomas have been appointed Public Analysts for the County of Glamorgan.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
4803	J. A. R. Hilderbrandt	Microscopes	9d.
4811	J. P. Kagencusch	Extracting Aluminium &c., from Clay, &c.	2d.
4870	J. Mactear	Furnaces for Chemical Purposes	8d.
5143	Ditto	Obtaining Crystallized Carbon	2d.
4891	F. White	Chemical Compound for Treatment of Hides	2d.
4896	Ditto	Manufacture of Chloride of Lime	2d.
4903	C. E. Scribner	Telephones	8d.
4918	W. R. Lake	Manufacture of White Lead	6d.
4970	Ditto	Farinaceous Food	6d.
5030	T. Morgan	Manufacture of Caustic Soda	2d.
5031	O. E. Pohl	Manufacture of Sulphates of Soda and Potassa	2d.
5041	E. Edmonds	Extraction of Iodine from Sea-wrack and Seaweed	6d.
5105	C. Wigg	Manufacture of Sulphates of Soda and Potassa	2d.
5109	R. Powell	Manufacture of Sulphite of Lime	6d.
5121	J. B. Freeman	Preparations of Zinc White	2d.
5127	T. A. Edison	Electric Lamps	6d.
5129	A. Fryer	Manufacture of Sugar	6d.
5156	S. Pitt	Obtaining Electric Light Regulators	8d.
5163	G. W. Von Nawrocki	Manufacture of Magnesia-Hydrate of Magnesia	2d.
5177	J. Mackenzie	Lighting Gas by Electricity	6d.
5197	H. J. Haddan	Purifying Gas	4d.
5206	G. André	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; Hydro Incubation by T. Christy; Report on Certain Epidemic *Outbreaks of* Enteric Fever by the Medical Officer of Health for Glasgow.

THE ANALYST.

SEPTEMBER, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A **General Meeting** was appointed to take place at Swansea, on the 27th Aug., but has been adjourned till November next, in London. We print some of the papers announced for the meeting.

ON THE ESTIMATION OF THE INSOLUBLE FATTY ACIDS IN BUTTER FAT.

By J. West-Knights, F.C.S., F.I.C.

Although much has been written within the last few years on this subject, the estimation of the insoluble fatty acids is still a very tedious process, and liable to serious error, chiefly on account of the difficulty of effectually washing a fatty substance with water, without incurring loss, and of the difficulty of transferring the fatty acids, when washed, to a vessel suitable for drying and weighing them in.

In the modification of the process about to be described, it is hoped that these difficulties have been removed, and the estimation rendered less tedious, more expeditious, and above all more accurate than the usual method of washing either in a flask or on a paper filter.

It is based on the insolubility of the oleate, stearate and palmitate of barium or calcium, and on the ready solubility of the butyrate, &c., of those metals.

Weighing the precipitate obtained by carefully neutralizing the saponified butter fat with acetic acid, and adding solution of barium or calcium chloride, and washing with boiling water, was first tried, but in practice it was so difficult to exactly neutralize the soap solution, and either fatty acids were precipitated or carbonate formed from the slight alkalinity, and the precipitate was with difficulty dried for weighing, and the results were unsatisfactory, probably partly owing to inconstancy in the composition of the precipitate ; and it will also be evident that the weight of the precipitate so obtained would not be directly comparable with the weight of insoluble fatty acids in different fats on account of the different combining proportions of the oleic, stearic and palmatic radicles.

It was therefore found necessary to weigh the fatty acids in a free state. To accomplish this, the acids were liberated, after washing the salt containing them, in contact with ether and a portion of the ethereal solution so obtained, evaporated to dryness.

In practice the process is conducted as follows :—A portion, 1—3 grammes, of clarified butter-fat is saponified by heating on the water-bath with about twice its volume of alcoholic potash, and the occasional addition of a few drops of boiling water, the combination is completed in about twenty minutes ; the solution is then diluted to about 300 c.c.

with cold distilled water, and solution of $BaCl_2$ added until a curdy precipitate separates, and the liquid is no longer rendered milky by a fresh addition, the precipitated salt is collected on a filter and washed with warm water, then transferred to one of the tubes described by Dr. Muter in his paper on the "Estimation of Oleine in Fats" (The Analyst, Vol. II., p. 74), which is a long graduated tube of 250 c.c., graduated from the bottom upwards, and furnished with a well ground stopper and a stopcock, which is placed at 50 c.c. from the bottom. As the mouths of these tubes are rather narrow, and consequently inconvenient for the introduction of the precipitate, the author uses one that has been cut off just below the shoulder and having a large stopper ground to fit accurately in the tube itself, which is one inch in diameter. Hydrochloric acid is added to the tube, which already contains the precipitate and the water used in washing it into it, when the fatty acids are liberated ether is added; if the watery liquid reaches above the stopcock, as it probably will if much water was required to transfer the precipitate, about 50 c.c. only of ether should be added at this stage. The tube, well shaken, is allowed to stand until the liquids have separated perfectly; now if the stopper be removed and the tube inclined forward, it is easy to draw off the bottom liquid from the cock until the level of it falls considerably below the cock when the tube is upright, without any loss of ethereal solution The rest of the ether is now added (a total quantity of 100 c.c. is sufficient) and the tube once more shaken and allowed to stand; the volume of the ethereal solution is now read off from the graduations of the tube and noted.

It is only required now to remove an accurately noted quantity of the ethereal solution to a tared flask; distil off the ether and weigh the fatty acids that remain; before measuring the required quantity for evaporation, about 1 c.c. should be drawn off in order that the delivery tube of the stop-cock may be filled and no correction needed for the quantity it would retain if the measurement had been commenced with the tube empty.

This method has been used in the author's laboratory for over six months, and has been found very satisfactory, as the whole operation can be concluded in a very short time, and very concordant results can be obtained in two analyses of the same fat, as the following extracts from the laboratory note-book will show:—

	Quantity taken.	Insoluble fatty acids.	Per cent.
No. 1. Butter fat	3·097 grm.	= 2·728	= 88·08
No. 2. Butter fat (Same as No. 1)	1·180 ,,	= 1·038	= 88·00
No. 3. Lard	1·016 ,,	= ·9769	= 96·15
No. 4. Almond Oil	1·179 ,,	=1·1321	= 96·02
Theory for pure Oleine		=	95·70

Either barium or calcium chloride may be used for the precipitation, but barium is preferred, especially for fats or oils containing much oleine, as the salt produced is less apt to stick to the sides of the beaker, and it is more easily washed with hot water, not being so liable to run into a plastic mass.

ON A NEW METHOD FOR THE ESTIMATION OF ORGANIC CARBON IN POTABLE WATERS.

PRELIMINARY NOTICE.

By Alfred Smetham, F.C.S.

It will, I think, be allowed that the estimation of the organic matters actually existing in potable waters is of the utmost importance in deciding their adaptability to domestic purposes. Unfortunately, the quantities to be dealt with are so exceedingly small, that any attempt to arrive at an intimate knowledge of their constitution is at present, practically impossible, and we are, therefore, compelled to have recourse either to comparative methods or to determine but part of their constituents. The methods by which these ends are attained are well known to all chemists. The old "ignition process," has long been abandoned as untrustworthy; and this, as far as my memory serves me, is the only method which attempts to determine the total amount of organic matters present. The processes which have found most general acceptation, are—1st, the Combustion Process, devised by Drs. Frankland and Armstrong; 2nd, the Albuminoid Ammonia Process, by Prof. Wanklyn; and, 3rd, the Permanganate Process, which has been enlarged upon of late by Dr. Tidy. The first of these methods may be designated for convenience an *absolute* method, whereas the other two must be considered as comparative. But although it is true that the last two processes give but comparative results, they possess a redeeming feature in the fact that they are applied to the water without previous treatment, whereas it is necessary in applying the first process to evaporate the water to complete dryness. The relative value of the different processes have, however, been so completely discussed that any criticism of mine would be presumptious. Before leaving this part of my subject, however, I must make mention of the process of Messrs. Wanklyn and Cooper, by evaporation with alkaline permanganate, which seeks to attain the same object as the process I am about to describe, but as I have seen no detailed account of accurate experiments I am unable to comment upon it.

The belief that greater reliance could be placed in the results if an accurate method could be devised for the estimation of the carbon and nitrogen without evaporation to dryness, induced me at the beginning of last year to start the experiments the result of which I propose to bring before your notice. I may, however, observe that all my attempts to obtain accurate results for the nitrogen have utterly failed.

The experiments which I made at the commencement were numerous, and resulted for the most part in failure, due either to the unsuitability of the apparatus used, or ignorance of the requisite precautions. It is needless, however, to state my failures and disappointments, but I will as briefly as possible describe the process and apparatus which I at present use.

The process is essentially an oxydation of the organic matter by means of bichromate and permanganate of potash in a sulphuric acid solution.

One litre of water under examination is acidified with phosphoric acid and evaporated in a water-bath with due precautions to about 50 c.c. It is then transferred to a small retort connected with an absorption tube, containing perfectly clear baryta water, to which in turn are attached two more washing tubes. The first bulb tube must be sufficiently large to allow about 100 c.c., to be contained in it; the second tube is intended as a "tell-tale," and the third to prevent the absorption of carbonic acid from the atmosphere.

Before use the parts are thoroughly cleansed, and baryta water, or caustic potash, is then placed in the last bulb-tube, and the other parts connected. An aspirator is then attached to the tubule of the retort and a current of washed air drawn through the apparatus. About 20 c.c. of a perfectly bright and clear solution of caustic baryta are then placed in the large bulb-tube, and a suitable quantity in the "tell-tale," and the whole apparatus attached again as quickly as possible.

The water which has been evaporated with phosphoric acid, is then gently boiled until the steam enters the absorption tube. The baryta water should remain perfectly clear, but if not the distillation must be continued until the last traces of CO_2 are expelled and the baryta water renewed.

The apparatus is then allowed to cool, and 1 gram of bichromate of potash, and 1 gram of permanganate of potash, together with 20 c.c. of sulphuric of 1·4 sp. gr. are then introduced. It is needless to state that special precautions must be observed in order to ensure the purity of the chemicals used, and that one or more blank experiments must be made.

A small gas flame is then placed under the retort and the liquid distilled very slowly. The steam is condensed in the U tube, and the carbonic acid, which accompanies it, is absorbed by the baryta water. No precipitation should take place in the second tube. The distillation is continued until about 20 c.c. remain in the retort.

When the operation is complete the precipitate in the tube A is filtered and washed first with water saturated with carbonate of barium, and finally with a little boiling water.

The apparatus which I have used up to the present to prevent the absorption of carbonic acid from the atmosphere during the washing, has consisted of a cap of india-rubber, which is affixed to the funnel containing the filter, and through which the contents of the U tube could be thrown upon the filter and washed without fear of absorption of CO_2 from the air. The method of Drs. Dupré and Hake, as given in the *Journal of the Chemical Society* (March 1879), will, however, I believe be found more convenient, but I regret to say that, up to the present, I have been prevented by stress of work from trying it. I have, however, to express my thanks to Dr. Dupré for the information he has given me upon this point.

The washed precipitate is then dissolved in a little dilute hydrochloric acid and converted into sulphate of barium, in precisely the same way as suggested by Dr. Dupré. From the weight of the precipitate, the amount of carbon is readily calculated. Owing to the high molecular weight of $BaSO_4$ a very small quantity of carbon will produce a tangible precipitate, the weight of the resulting $BaSO_4$ being nearly twenty times as great as the original carbon.

The precautions to be observed are chiefly the following:—Perfect expulsion of CO_2 from the water, perfect purity of chemicals, sufficient time during the distillation, complete washing of the resulting $BaCO_3$ without loss or absorption of CO_2 from atmosphere.

The sulphuric acid will, of course, decompose the nitrates and chlorides in the water, and the corresponding acids will distil, but as these form soluble salts they do not interfere with the operation. I have not found that more than traces of sulphuric acid are carried over, but even should there be a small quantity, the resulting $BaSO_4$ is retained on the filter and does not interfere with the accuracy of the determination.

The heat must be so regulated that the steam carried over will all condense in the forepart of the U tube. In practice I have found the apparatus to answer well, there being no chance of loss of CO_2 by any unnecessary apparatus.

The oxydation would appear to be complete in nearly all cases—the substance, as far as my experiments have extended, which has proved most refractory, being urea, but this even yields about 80 per cent., and in one case, by the subsequent addition of 10 c.c. of strong sulphuric acid and a little permanganate of potash, I obtained results slightly above the theoretical. This leads leads me to hope that, by continuing the distillation a little longer, *better results* may be obtained.

I do not propose to give a statement of the experiments I have made, as I intend reserving these until I have completed the series which I have sketched out, but I will give the actual figures which I obtained from five substances, which I think may be considered as typical.

1st. ·0500 of sugar (Tate's crystals which on polarization and analysis proved to be quite pure) were treated as stated above.

Carbon found	·02147	gram.
Carbon present	·02105	,,

2nd. *Benzoic Acid.* Quantity taken, ·0300 gram.

Carbon found	·02042	gram.
Carbon present	·02065	,,

3rd. *Isinglass.* Quantity taken, ·0580 gram.

(Schorlemmer states percentage of carbon as 49·3.)

Carbon found	·02857	gram.
Carbon present	·02859	,,

4th. *Picric Acid.* Quantity taken, ·1080 gram.

Carbon found	·03432	gram.
Carbon present	·03395	,,

5th. *Urea.* Quantity taken, ·0590 gram.

Carbon found	·00932	gram.
Carbon present	·01180	,,

In another experiment by the subsequent addition of 10 c.c. of strong sulphuric acid and a small quantity of permanganate of potash, figures slightly above the theoretical were obtained.

Urea. Quantity taken, ·1015 gram.

Carbon found	·02092	gram.
Carbon present	·02030	,,

The quantities operated upon are about 10 times as great as in the London waters and consequently the errors would be proportionately diminished.

The process requires accuracy of manipulation and the strictest attention to the precautions before mentioned, but the same must be said of any process having to deal with the small quantities of organic matters present in drinking waters.

It is, I am aware, a serious objection to the process that no account is taken of the organic nitrogen, but the carbon alone is useful, and in conjunction with the other constituents will throw a considerable amount of light on the purity.

I may here be allowed to say a few words on the necessity of making a complete, or tolerably complete, analysis of every sample of water before reporting. To trust merely to two or three determinations I believe to be an error into which many chemists fall; and although I allow that in many instances a water may be condemned even on a single test, still no true opinion can be formed without a much more complete analysis than is sometimes made. In doubtful cases especially, no pains should be spared to make the analysis as complete as possible. Were the noxious matters known with certainty we might be able to detect them in the water, but as we are as yet without definite knowledge on this point, it is the duty of the chemist to condemn any water which bears evidence of contamination with drainage or sewage matters to any considerable extent. The amount of contamination which we consider to be innocuous is a purely arbitrary quantity, and each chemist must be his own judge and base his opinion on a consideration of the whole of the constituents, and his knowledge of the history of the water. Taken, therefore, in conjunction with the other constituents, I believe the carbon to be very useful in determining the adaptability of a water to potable purposes.

THE EFFECTS OF ALUMINA SALTS ON THE GASTRIC JUICE IN THE PROCESS OF DIGESTION.

By Henry A. Mott, Jun., Ph.D.

This paper gives a description of the experiments made by the author upon living dogs, to show the effects of alumina salts on the system, when alum is used in the preparation of baking powder.

Two dogs, of 30 lbs. and 35 lbs. weight, were given eight biscuits each, containing about a teaspoonful of "alum baking powder:" in about four hours both were very sick and vomited, with trembling in the limbs, bowels at first very loose, afterwards constipated; the next day appetite did not return and one of them vomited frequently.

Three more dogs, weights varying between 10 lbs. and 40 lbs., were fed with biscuits containing half as much of the alum baking powder as the above: the smallest dog was sick and vomited one and-a-half hours after, the second was very loose in the bowels, and the largest very constipated; the next day all were extremely constipated, and the smallest dog would eat no more of the biscuits.

Three more dogs were fed with biscuits made with "cream of tartar baking powder" in the same proportion as in the case of the first two (viz.: 20 teaspoonfuls to a quart of flour); their weights were 15 lbs., 20 lbs. and 35 lbs. respectively: the two largest were fed entirely on the biscuits for two days, ate well, and were not in any way affected; the smallest dog was fed on the biscuits for four days and ate with the same appetite without showing the slightest sign of sickness.

Four dogs were fed with precipitated hydrate of alumina mixed with meat: one weighing 18 lbs. was given 163 grains mixed with meat: after two hours he vomited for nearly three hours; another of 20 lbs. weight was given 54 grains: in four and a half hours he was sick; the other two were similarly affected. The meat was vomited during the night undigested.

One dog was fed with phosphate of alumina mixed with meat, and although he did not vomit he quickly lost his liveliness and brightness of eye and was evidently quite sick.

Four more dogs were fed with meat mixed with burnt alum: all of them were taken with violent sickness, and vomiting, and trembling in the limbs, when so little as one-fourth or one-eighth of an ounce only had been taken.

The author next describes experiments made with gastric juice.

To 3 grms. of gastric juice obtained from healthy dogs was added ·0403 grm. fibrine, and kept at a temperature of 95—100° F. for half-an-hour; the fibrine was entirely dissolved.

To 3 grms. more of the gastric juice was added 0·5 grm. hydrate of alumina and ·0403 grm. fibrine: after two hours at a temperature, 85—100° F. and twenty three hours at ordinary temperature, only one-fourth of the fibrine was dissolved.

To 3 grms. more was added 0·5 grm. alum and ·0403 fibrine: after two hours at 95—100° F., and twenty-three hours at ordinary temperature, three-fourths of the *fibrine only* was dissolved.

To 3 grms. of the juice was added 0·25 grm. of coagulated white of egg: after two hours' digestion at 95—100° F., half was dissolved; and on the addition of 3 grms. more, and a further digestion of two hours, it had completely disappeared.

To 3 grms. of gastric juice and ·25 white of egg, was added ·031 grm. of hydrate of alumina: after two hours' digestion at 95—100° F., and 15 hours' contact at ordinary temperature, not a particle had dissolved.

To 3 grms. of gastric juice and ·25 grm. of white of egg, 0·25 grm. of alum was added: after digestion, as before, not a particle of albumen had dissolved.

To 3 grms. of gastric juice and 0·1 gramme of white of egg, 0·1 grm. of phosphate of alumina was added: after digestion, as before, none of the white of egg had dissolved.

The author further had dogs that had been fed with food containing hydrate and phosphate of alumina for four days, killed and examined: he found alumina in the blood, heart, liver, spleen and kidneys.—*Journal of the American Chem. Soc., Vol. II., No. 1.*—J.W.K.

ANALYSES OF BLACK AND WHITE MUSTARD.

By Charles H. Piesse and Lionel Stansell.

The seeds of black and white mustard, *Sinapis nigra* and *S. alba*, when crushed and sifted constitute the mustard farina of commerce; both species are cultivated in this country, a considerable quantity, however, being imported from abroad. In the manufacture, the seeds of both variety in suitable proportions are crushed between rollers, then pounded and sifted. The residue in the sieve is called dressings; what passes through is farina or flour of mustard. This is re-sifted, yielding three qualities: (*a*) superfine, (*b*) fine, and (*c*) seconds. The seeds are tough and difficult to powder: the best method on a small scale is to pulverise them in an ordinary morter with a large cast iron pestle.

The farina of black and white mustard differs but little in appearance, the brown being, however, slightly darker. In the unground state the seeds of white mustard are of a yellowish straw colour, those of brown a dark brownish purple.

A. 1 gram white seeds, Yorkshire, contain 170 seeds.
B. 1 " " " Cambridge, " 172 "
C. 1 " brown " Cambridge, " 944 "

100 seeds of A weigh ·5882 grm., B ·5814 grm., C 0·1059 grm.

***Methods of Analysis Employed.*—The *Sulphur* was estimated by oxidation with concentrated nitric acid, and subsequent precipitation with barium chloride.**

For the determination of *Nitrogen* the soda-lime method was employed, the evolved ammonia being passed into standard acid. Mustard contains so large a proportion of fat, that during the combustion the amount of tar produced considerably interferes with the subsequent titration. It was therefore found necessary to exhaust a weighed quantity of the crushed mustard seeds (previously dried) with petroleum ether, to collect the exhausted mustard on a weighed filter and to dry it, then after re-weighing to calculate the ratio between the original mustard and that free from fat and moisture. A weighed quantity of

this exhausted mustard was then used for the estimation of the nitrogen. By this expedient the production of tar during the combustion was almost entirely prevented. The amount of nitrogen, after subtracting that contained in the potassium myronate*, in the case of black mustard, is multiplied by 6·25 to obtain the albuminoid substances.

Substances Soluble in Water (Myrosin and Albumin).—The amount of myrosin and soluble albumin appears not to differ in either variety. About two grammes of substance well digested for twelve hours with cold water, the fluid then filtered into a quarter litre flask, and the seeds washed thoroughly with cold, warm, and finally boiling water. Of the filtrate, 50 c.c. were evaporated to obtain the total soluble matter; 100 c.c. were boiled, and the coagulated albumin collected on a weighed filter.

Fat and Cellulose.—(*a*) About 2 grams of finely pulverised seed well dried; (*b*) extracted with petroleum ether, the insoluble matters collected on a weighed filter, dried and weighed; (*c*) boiled successively with very dilute hydrochloric acid, caustic soda, and hydrochloric acid, being washed with boiling water each time, finally with alcohol, dried, and weighed as cellulose.

Estimation of the Volatile Oil.—The distinguishing characteristic of brown mustard is the occurrence in it of potassium myronate, which, in presence of water, is acted upon by a peculiar ferment—myrosin, contained in the seed, whereby it is decomposed, yielding potassium, hydrogen sulphate, glucose, and allyl iso-thiocyanate, the pungent oil of mustard :—$K, C_{10}H_{18}NS_2O_{10} = KHSO_4 + C_6H_{12}O_6 + C_3H_5,CS, N$. 100 parts potassium myronate yield 23·855 volatile oil.

It is remarkable that the yield of volatile oil is greater when the brown mustard is mixed with some of the white. The results of many experiments have led to the following process :—

About 25 grams of the crushed brown seeds are mixed with about a quarter of their weight of white seeds (also crushed), in a 500 c.c. flask, 300 c.c. cold water added and allowed to stand for five or six hours. The highest yield of oil is obtained by standing for this length of time, and sensibly diminishes after six hours, gradually decomposing in contact with the myrosin; the yield after the lapse of 48 hours will reach only about two-thirds of that originally present, while after a week not one-third of the whole will be obtained. We have found after numerous trials that not less than three hours nor more than six should be allowed to elapse between the addition of the water to the mustard and its distillation, the rule finally adopted being to allow the mixture to stand for five hours. The flask is then to be connected with a small Liebig's condenser, and the liquid distilled until no more oily drops are seen to come over. The distillate is received in a small flask (150 c.c.), containing 30 c.c. ammonia sp. gr. 0·88. When the distillation is judged complete, the flask is disconnected and, after removing from the flame, shaken. If the steam possesses the sharp pungent odour of mustard oil, the contents are further distilled. This test is very sensitive. When the boiling proceeds rapidly, after 50 c.c. have come over, it will almost invariably be found that the mustard is entirely deprived of volatile oil. The distillation finished, the condenser is well rinsed out with cold distilled water into the receiver (this is necessary), the flask corked and put aside until the oily drops have quite disappeared, being occasionally shaken for this purpose; at least 24 hours are usually requisite. When the change is complete the flask is covered with a porcelain crucible lid, and boiled for a few minutes to expel the ammonia, transferred to a weighed platinum basin, and evaporated to dryness on the water-bath, subsequently dried in the water oven, and weighed. The amount of thio-sinamine thus obtained is multiplied by ·85344: the product is the quantity of allyl iso-thiocyanate contained in the mustard operated upon. If the factor 3·5775 be used, the amount of potassium myronate is ascertained.

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* Potassium myronate contains 3·37 per cent. of nitrogen.

Thio-sinamine is formed by the union of one molecule of ammonia with one molecule mustard oil.

$$CS,N,C_3H_5 + NH_3 = CS,\left\{\begin{matrix} NH,C_3H_5. \\ NH_2. \end{matrix}\right.$$

ANALYSES OF WHITE MUSTARD.

	Mustard Whole Seeds.		Mustard Farina.		
	Yorkshire.	Cambridge.	Superfine.	Fine.	Seconds.
Moisture	9.32	8·00	·30	5·78	6·06
Fat	25·56	27·51	37·18	35·74	32·55
Cellulose	10·52	8·87	3·90	4·15	9·34
Sulphur	0·99	0·93	1·33	1·22	1·26
Nitrogen	4·54	4·49	5·05	4·89	4·25
Albuminoids	28·37	28·06	31·56	30·56	26·56
Myrosin and Albumin	5·24	4·58	7·32	6·67	6·11
Soluble Matter	27·38	26·29	36·31	36·60	33·90
Volatile Oil	0·06	0·08	0·03	0·04	0·03
Ash	4·57	4·70	4·22	4·31	4·30
„ Soluble	0·55	0·75	0·44	0·55	0·33

ANALYSES OF BROWN MUSTARD.

	Mustard Whole Seeds.	Mustard Farina.		
	Cambridge.	Superfine.	Fine.	Seconds.
Moisture	8·52	4·35	4·52	5·63
Fat	25·54	36·96	38·02	36·19
Cellulose	9·01	3·09	2·06	3·26
Sulphur	1·28	1·50	1·48	1·30
Nitrogen	4·38	4·94	5·01	4·31
Albuminoids	26·50	29·81	30·25	26·06
Myrosin and Albumin	5·24	6·46	6·78	6·14
Soluble Matter	24·22	31·64	32·78	31·41
Volatile Oil	0·473	1·437	1·500	1·381
Potassium Myronate	1·692	5·141	5·366	4·940
Ash	4·98	5·04	4·84	4·91
„ Soluble	1·11	1·01	0·98	0·77

In the process of manufacture, the sifting chiefly removes the husk, and dries the farina, the other constituents being, as it were, concentrated. This is well seen in the amount of volatile oil in brown mustard. Again, the fat, which averages about 25 per cent. in the seeds, reaches 37 per cent. in the farina; the sulphur is increased nearly one-half of one per cent., and so on with the other constituents; while the cellulose falls about two-thirds and the moisture about one-half.

The white seeds differ in composition from the brown, chiefly in not yielding volatile mustard oil, in the fact that the sulphur is lower, and the soluble matters higher in the former than in the latter.

The results of over 40 experiments upon the amount of volatile oil present in brown mustard are here shown, a few of the separate determinations being given:—

					Volatile Oil per cent.
Whole Mustard Seeds...	0·486	0·465	0·468	...	Average 0·473
Brown Farina, Superfine		1·439	1·436	...	do. 1·437
Do. *do.* Fine	1·51	1·49	1·50	...	do. 1·500
Do. *do.* Seconds	1·358	1·418	1·367	...	do. 1·381

Characteristic Tests.—I. The aqueous extract of white mustard yields with solution of ferric chloride a deep blood-red colouration; this reaction is so slight as to be scarcely apparent with a similar extract of black mustard.

II. The aqueous extract of white mustard acquires in a few hours a powerful odour of sulphuretted hydrogen: that of the black mustard smells only of the pungent mustard oil.

ANALYSES OF ASH OF MUSTARD SEED.

	White Seeds.		Brown Seeds.
	Yorkshire.	Cambridge.	Cambridge.
Potash	21·29	18·88	21·41
Soda	0·18	0·21	0·35
Lime	13·46	9·34	13·57
Magnesia	8·17	10·49	10·04
Iron Oxide	1·18	1·03	1·06
Sulphuric Acid	7·06	7·16	5·56
Chlorine	0·11	0·12	0·15
Phosphoric Acid	32·74	35·00	37·20
Silica	1·00	1·12	1·41
Sand	1·82	1·95	1·38
Charcoal	12·82	15·14	7·57
	99·85	100·48	99·70

When the charcoal and sand are deducted, the following is the percentage composition of the ash. An analysis made in 1850 by Way and Ogston of White Mustard is appended:—

	White Seeds. Yorkshire.	White Seeds. Cambridge.	White. Wag & Ogston. 1850.	Brown Seeds. Cambridge.
Potash	24·98	22·64	25·78	23·59
Soda	0·21	0·25	0·33	0·38
Lime	15·79	11·19	19·10	14·95
Magnesia	9·58	12·58	5·90	11·06
Iron Oxide	1·38	1·23	0·39	1·16
Sulphuric Acid	8·28	8·58	2·19	6·12
Chlorine	0·12	0·14	trace.	0·16
Phosphoric Acid	38·48	41·97	44·97	40·99
Silica	1·17	1·34	1·31	1·55
	99·93	99·92	99·97	99·96

The ash for analysis was obtained by careful incineration at a heat below visible redness.

It will be noticed that the ash consists mainly of potassium, calcium and magnesium phosphate, with a very minute proportion of chlorine; and that no carbonates are present. Practically no difference exists between the ashes of the two varieties, so that no analytical indications can be obtained from the mere examination of that constituent.

We append a few reactions of thio-sinamine likely to prove of interest:—

I. Thio-sinamine dried at 100° is an oily substance, which solidifies when cold after some time. It dissolves readily in hot water, and crystallises therefrom in beautiful tufts of crystals (monoclinic).

II. Treated with nitric acid, it is partially oxidized, though even boiling with the concentrated acid for half-an-hour failed to effect complete decomposition, as evidenced by the percentage of sulphuric acid obtained by precipitating the liquid with barium chloride.

III. Silver nitrate added to an aqueous solution of thio-sinamine gives a white curdy precipitate, which redissolves less and less perfectly until the silver salt is in excess, when the precipitate remains permanent.

IV. Mercuric chloride gives a reaction precisely similar to silver nitrate.

V. Platinic chloride gives an abundant curdy orange-yellow coloured precipitate, which does not redissolve in the excess of thio-sinamine, nor in cold water. In hot water it dissolves after first melting and floating to the surface, and on cooling separates as an opaque mass of the consistence of balsam tolu, in which condition it remains. This salt, as well as the two before mentioned, is readily soluble in alcohol.

VI. Mayer's reagent (HgI_2+KI) yields a dirty white coloured precipitate, which coheres in a few hours to form a number of oily drops. This change occurs at once on heating. The precipitate is only slightly soluble in either hot or cold water.

VII. Nessler's solution gives an insoluble yellow precipitate.

VIII. Picric acid only affords a precipitate in strong solutions.

For kindly placing at our disposal the various samples of mustard seeds and farinas, we are indebted to Messrs. Keen, Robinson, Bellville & Co., to whom we return our best thanks.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—In your issue of this month there appears a criticism on my paper on the Estimation of Phosphoric Acid by Messrs. Teschemacher and Smith, in which the authors assert that my paper "bristles with misdescriptions, misdirections, misstatements and mistakes," and then go on to justify this statement. The objections brought against it seems to consist chiefly of the following:—brevity of diction, the omission of part of a long title, a misquotation from their pamphlet, and the omission of any remarks on the estimation of moisture. 1st. With regard to my brevity of diction I have nothing to say, except that it was a perfectly safe point of attack, since no one can accuse your correspondents of a like error. What Mr. Square and the Christian religion, M. Gambetta and the Jesuits have to do with the point at issue I fail to see! 2nd. More than half a page is occupied in a long tirade against the omission of the words "by magnesia for commercial purposes." If the writers had read carefully they would have noticed that I did not quote the title at all, but simply stated that the pamphlet was on the Estimation of Phosphoric Acid, a statement which I presume was strictly accurate. It seems, however, that the clause "for commercial purposes" is quoted as an excuse for the neglect of the solubility. Those persons who only analyse "for commercial purposes," without regard to scientific accuracy, are not worthy of the name of chemists, and if in their pamphlet there is no pretence to scientific accuracy all argument is at an end. 3rd. The misquotation of which I was guilty was that Messrs. Teschemacher and Smith had stated that ammonio-magnesic phosphate is "totally insoluble in water containing one-eighth of its bulk of ·880 ammonia." The experiments which I had in my mind when I made that statement were given at the end of their pamphlet. A certain quantity of ammonio-magnesic phosphate was taken, and dissolved and precipitated a great number of times, and, on finally weighing, the weight was actually found to have increased! It is therefore not merely totally, but even more than totally, insoluble! It is evident that impurities from some source had been introduced, and who can say that they were not sufficiently great to counterbalance a perceptible solubility? I must, however, apologise for the use of the word "crude," and assure the authors that nothing was more foreign to my mind than to say anything which should give annoyance. 4th. I made no reference to the determination of water. I was, until lately, under the impression that the merest tyro in analytical chemistry knew that to obtain accurate results the quantity taken for analysis must represent, or bear a determinate ratio to, the sample as received, otherwise the analysis is worse than useless. It would be an insult to the readers of THE ANALYST to describe in detail the method by which correction is made for moisture. Having now disposed of the principal objections, I may be allowed to say a few words on the general tenor of the criticism.

The only accurate method of determining the solubility is by treating the filtrates; the errors in weighing, &c., masking all attempts to obtain accurate results by treating the large precipitates. It will thus be seen that the precise quantity of phosphate solution taken is immaterial, the only precaution required being to remove the precipitate completely.

Messrs. Teschemacher and Smith make the statement that they never doubted the solubility. Why then, I ask, object to the exact quantity being determined? If my experiments are correct, the allowance ought to be made, and if not they should accurately determine the amount of solubility, and if they can refute my statements. There is, however, a considerable difference between "vamping up" an analysis by the addition of two per cent. which is known *not* to be in solution, and an addition of 0.18 per cent. based on careful experiments. In reply to the statement that the influence of citric acid, iron and alumina on the solubility are matters which "may be investigated by the curious," I would remark that these substances are usually present to a greater or less extent during the actual analysis, and will exert their influence on the solubility, and it is, therefore, more than a matter of curiosity.

Finally, your correspondents practically accuse me of plagiarism, and state that the process as given by me is theirs shorn of all precautions. It must be remembered, however, that I was talking to a body of well-trained chemists who understood their profession, and not to office-boys and clerks into whom I wished to instil sufficient knowledge to enable them to estimate phosphoric acid "for commercial purposes." I would, moreover, remind the writers that four years or so ago they omitted two of the most important precautions which must be observed in applying this method, viz., the purification of the precipitate by resolution and reprecipitation, and the fact that small quantities of phosphoric acid are taken down with the oxalate of lime. At the time that Messrs. Teschemacher and Smith ignored these points, I had already made several thousand analyses, observing these precautions. Some twenty years ago Dr. Voelcker published in the *Journal of the Royal Agricultural Society* the method in all its important particulars, and although he had improved the method very considerably, he does not claim originality.

When it is remembered the source whence Messrs. Teschemacher and Smith obtained their information on the points mentioned above, it is certainly too bad to even hint at plagiarism, and had they given the matter serious consideration they would, I doubt not, have refrained from making statements which are as ungenerous as they are unfair.

I am, &c.,

August 7th, 1880. ALFRED SMETHAM.

TO THE EDITOR OF "THE ANALYST."

SIR,—I thank you very much for the opportunity of saying a few words in reply to your remarks upon my letter that appeared in the *Cowkeeper's and Dairyman's Journal*. I do think it would have been more advisable to have reserved some of your remarks until I had failed to prove what I had stated. But you seem to me to have a settled conviction that no milk dealer could either speak the truth or be honest; but I tell you that it is only the exception when they fail to do either. I know there are good men in the milk trade, who make good husbands, good fathers, good citizens, and good Christians.

You say the charges I have made are quite new to you. That may be, but they are an old standing grievance with us. For we endeavoured last year to introduce the following clause into the Sale of Food and Drugs Act:—"That the certificate of the Public Analyst shall in all cases contain the component parts as ascertained by quantitative analysis. If such certificate do not contain the component parts it shall not be received as evidence." We have also decided some time ago that in all cases that we defend the analyst shall be asked for each separate item in his analysis. In regard to the first point mentioned, that neither the standard or the result is given, my proof is that in every case that I have heard tried either in Manchester or Salford, I have never heard it mentioned once, unless in reply to some question asked. The usual programme is, "Have you received a certain sample of milk?" "Yes." "And what is your result?" And the stereotyped reply is, "So much added water; but the standard we take is a very low one, with a fair average milk it would be so much." By this system one standard is adopted, and we are often convicted by another. I appeal to you, sir, to say if this is either just or fair to us, and when such vague and indefinite assertions are taken as evidence I say it is impossible to put the slightest check upon any one, and a man might make five hundred blunders and never be found out. I think you will admit with me that this is a most unsatisfactory state of things when honest men's reputation is at stake. My reply to the second charge is, that in all convictions here we are charged twenty-one shillings for the analyst's fee, and I presume he will receive this sum the same as any other witness.

I wish to say that neither directly or indirectly do we wish to say one word against the Public Analysts. All that we want is fair play, and that when we leave the court, whether convicted or not, we are satisfied that we have had a fair trial. We would not have the Act removed if we could, and we neither give help or sympathy to those who would set it at defiance.

I am anxious to call your attention to the different results by different analysts. Some months since a friend of mine in Salford was fined for milk showing 9½ per cent. of cream, which in my opinion is good milk. The same day I had a sample taken at my own request; this showed 5½ per cent. of cream. The next day the inspector took a sample of the farmer's milk, and this showed 4½ per cent. of cream: this milk was no better than what I usually sell for skim milk, yet the Liverpool Public Analyst, to whom the sample was sent by the local authority, said it was very good milk for the time of the year. I was losing customers daily, the milk was so poor, yet could get no help, and my friend who was selling good milk was fined. Differences like this do shake our confidence in the work of the Public Analyst.

In conclusion, we think, as milk dealers, we have just grounds for complaint. We have suffered more than all the rest that come under this Act. We are entirely in the hands of the Public Analyst; only his word is taken, and to refer to Somerset House is useless, as the sample is decomposed when wanted. For years we have suffered for the sins of the farmers, and even yet it is the great source of adulteration, and little effort is made by those in authority to check it, even now they have the power. Only let these gentlemen do their duty and see that our milk supply is good to begin with, and there will be few milk dealers prosecuted.

Apologising to you for wishing to occupy so much of your space,

I remain, yours, &c., ROBERT EDGE.

To the Editor of "The Analyst."

Dear Sir,—One of the Dublin Police Magistrates has just decided that the person in charge of a milk cart, delivering milk from house to house, is justified in refusing to serve an Inspector. Perhaps some of your readers might know of cases in which a contrary decision was arrived at. If so, I would feel greatly obliged by their communicating with

Yours faithfully,

CHARLES A. CAMERON,

Public Analyst for Dublin.

Royal College of Surgeons, Dublin,
24th August, 1880.

[*.* Our Law Reports, in this number, contain a case of a man being fined £5 for refusing to serve an Inspector from a cart, and doubtless some of our readers could refer Dr. Cameron to similar decisions.—Editors.]

ANALYST'S REPORT.

At the quarterly meeting of the Bristol Council, the report of the Public Analyst was presented. Of twenty samples analysed, five were brought by the public and fifteen by the inspector. Two were found to be adulterated. On the suggestion of the Town Clerk the report was simply allowed to lie on the table, as the appointment of the analyst had not yet been confirmed by the Local Government Board.

A Libel on Chemists.—Among our Local Reports will be found an account of a prosecution at Greenwich under the Sale of Food and Drugs Act, in which a chemist was fined £5 and costs for selling tincture of quinine containing ·67 per cent. of quinine sulphate and ·66 per cent. of sulphates of other alkaloids. The tincture of the Pharmacopœia should contain 1·91 per cent. of sulphate of quinine. The defendant admitted that he had put six instead of eight grains into the tincture, and declined to say if what he put in was sulphate of quinine. It seems hardly necessary to spend words in condemning such proceedings. Chemists, of all persons, have reason to desire that any such fraud should be punished whenever it has been proved to have occurred. But for all that the trade must expect to share to some extent in the minds of an unreasoning public the obloquy which Mr. Morton has brought upon himself. But a great deal worse than Mr. Morton's delinquency, as it affects the trade, was the astounding evidence which is reported to have been given in his favour by a certain Mr. Benjamin Browning, M.R.C.S., of Rotherhithe, who said, "It was by no means uncommon to find other alkaloids in a sample of quinine. Sulphate of cinchonine was a common substitute for quinine, and was used to his knowledge in both University College and Guy's Hospitals. *If he were prescribing for a patient and prescribed quinine, cinchonine would be used unless the word* 'vera' *were written after quinine.*" We have had some experience of the enmity of the medical profession towards us, but that has not hitherto done us much harm. Better a thousand times that we should retain the enmity than that we should be subject to such friendly assistance as Mr. Browning, of Rotherhithe, has to offer. For six years the Sale of Food and Drugs Act has been in force. During all that time chemists have endured the close and even hostile scrutiny of the authorities. Most of the prosecutions undertaken against chemists have been defeated, though the chemist has had to bear ruinous costs in proving his innocence, and yet this Mr. Browning, M.R.C.S., Medical Officer of Health for Rotherhithe, has the hardihood to assert, or to imply, that chemists, as a body, are accustomed to substitute cinchonine at 3*s*. an ounce for quinine at 12*s*. That statement would hardly pass uncontradicted even in the Society of Public Analysts. We should much like to ask whether Mr. Browning is accustomed to dispense his own prescriptions: many people are apt to assume that the rest of the world is only a magnified reflection of their own important selves. Mr. Browning's uncontradicted libel has been telegraphed all over the country. Nearly every provincial paper has printed a more or less complete report of the case, and in his privileged position as a witness Mr. Browning has done us a wrong which he, at least, can never repair.—*Chemist and Druggist.*

LAW REPORTS.

Tincture of Quinine:—

At the Greenwich Police Court, on Friday, July 30, Henry Morton, chemist, Broadway, Deptford, appeared to an adjourned summons at the instance of the Greenwich Board of Works, under section 4 of the Sale of Food and Drugs Act, for having mixed a drug, to wit, tincture of quinine, with ingredients or materials so as to affect injuriously the quality or potency of such drug, with intent that the same might be sold in that state, and did sell such drug so mixed as aforesaid to Inspector Corden. Mr. J. Spencer, solicitor to the Greenwich Board of Works, appeared to prosecute; Mr. J. C. Scard, solicitor, defended. Thomas Corden, inspector of nuisances under the Greenwich Board of Works, said on June 16th he went into the defendant's shop in Deptford Broadway and asked for 3 oz. of tincture of quinine. The defendant served him, and witness paid 1s. 8d. He then divided the drug into three parts, and told the defendant he had purchased it for the Greenwich Board of Works for the purpose of being analysed by the Public Analyst. Whilst witness was engaged in gettingsome sealing-wax out of his pocket for the purpose of sealing up the bottles, the defendant seized two of the bottles containing the *tincture of quinine,* and went out of the shop into a room. When he returned he said, "I intend to keep those two"—meaning the two bottles he had taken away—but afterwards said, "The fact is, I have thrown them away." The defendant said he would mix witness some more, as "he had made a mistake in the grains, having put six grains instead of eight grains to the ounce;" but witness refused this offer, took the remaining sample, and told defendant he should report the case to the Greenwich Board of Works. The certificate of the Public Analyst (Mr. Wigner) was then handed in: it set forth that the sample "contained quinine sulphate ·67 per cent.; other alkaloids and sulphates, ·66 per cent. Tincture of quinine, according to the British Pharmacopœia, should contain 1·83 per cent. of sulphate of quinine. This sample is, therefore, more than 60 per cent. deficient, and some other comparatively worthless alkaloids have been added to partially make up the deficiency." Mr. Wigner, the analyst, said the market price of sulphate of quinine was about 12s. per oz., and the other alkaloids 3s. The sample would have little value or effect as a medicine. The alkaloids would undoubtedly injuriously affect the potency and quality of the tincture of quinine. The certificate from Somerset House was produced by Mr. Spencer. It specified that the sulphate of quinine in the sample was not more than one-fifth of the proper quantity. Dr. B. Browning, M.R.C.S., was called for the defence, and said it was by no means uncommon to find other alkaloids in a sample of quinine. Sulphate of cinchonine was a common substitute for quinine, and was used to his knowledge in both University College and Guy's Hospitals. If he were prescribing for a patient, and prescribed quinine, cinchonine would be used, unless the word "vera" was written after quinine. Mr. Browning gave some further technical evidence, and said there were three other alkaloids used in quinine equal in quality and potency though not in market price. The defendant was then sworn, and said he sold the sample of quinine in a fair and honest way, to the best of his knowledge; but, as he told the inspector, he put six grains instead of eight to the ounce. Mr. Spencer: But was it sulphate of quinine you put in? Defendant (hesitating): I decline to answer the question. Mr. Scard objected technically to the summons being taken under the 4th section, which said, "except for the purpose of compounding;" and he would submit that, the sample having been mixed or made up on the premises, was therefore sold as a compound. He would submit that the summons might have been taken out under the 6th or 7th section, but not under the 4th. Mr. Marsham, the magistrate, said he thought the case came within the 4th section, for the evidence of the defendant himself only went to show that it came under the 4th section. Perhaps there was nothing in the sample deleterious, but he was convinced that the quality and potency of the drug had been affected by the addition of the alkaloids, whereby it would not have had the effect on the patient it should have had. It was a case he could not pass over lightly. As it was, the defendant had laid himself open to a penalty of £50 in this case, but he did not mean to inflict that penalty. He would fine the defendant £5 and 20s. costs. The defendant paid the money, and left the court.

Refusing to Serve Inspector from a Cart. Heavy Fine :—

At the Brentford Petty Sessions, John Nash, in the employ of Westlake and Co., dairymen, of 60, Norfolk Terrace, Westbourne Park, was charged with refusing to sell a pint of milk to Inspector Gregg. The inspector found him selling milk from a cart, and asked for a sample to inspect. The defendant skimmed his measure along the top, and offered the contents. The inspector asked him to put his measure into the can and take a fair sample. This he refused to do. The inspector asked for a sample out of another can, and offered 1s. as a fair price for the sample. He was again met with a refusal. The inspector also asked to look at the measures; but the man said they had got the Government stamp on, and that was quite enough. The defendant was fined £5.

Another Refusal to Serve. Under New Act Defendant may be called as Witness:—

At Lambeth Police Court on the 28th July, George Bayley, cowkeeper, Ivy Cottage, Wyndham Road, Camberwell Road, was summoned at the instance of the vestry for refusing to supply Donald McKay, one of the sanitary inspectors, with two-pennyworth of milk for the purpose of being analysed. Mr. Marsden, the vestry clerk, appeared in support of the summons. McKay stated that he saw the defendant in the street before seven o'clock one morning, and, producing a jug, asked to be supplied with two-pennyworth of milk from a can out of which he had supplied a customer. He took the mug and was serving him out of another can, which the witness refused, saying he was a sanitary inspector, and wanted the milk for an analysis. He tendered the money, and pointed to one of the three cans. He saw no milk marked "skimmed" on the cans. A point arose in this case under the new Act. A person named Smith, who said he was with the inspector, confirmed his evidence. On cross-examination he was asked if he frequently acted as a "detective" in such cases, and Mr. Chance, the presiding magistrate, told him he need not answer such a question. Mr. Armstrong said he was instructed that the defendant denied the evidence given, but unfortunately he could not call him. Mr. Chance said, under the new Adulteration Act, defendants were competent witnesses. Mr. Armstrong said that as that was the case he should certainly call him, and also his friend who was with him. The defendant and his friend were called. They said that they had served a customer before McKay asked for milk, but refused to let him have milk out of one of the cans, as it was skimmed milk and so labelled. He (defendant) admitted that he knew McKay, and said milk dealers and cow-keepers "trembled" when they saw him. He trembled when he saw him. Mr. Chance told him that no one need "tremble" if he was selling a pure article. The defendant said he had offered to sell him milk, but he refused to have it. He said he had been before convicted, not for refusing to sell, but for adulterated milk, and had been twice convicted for the offence. Mr. Armstrong urged that as the defendant had offered to sell milk he could not be convicted of "refusing to sell milk" to the inspector. Mr. Chance said it would make the law nugatory if when a man has refused to supply milk out of one can, he could defeat the Act by saying that he had offered to sell it out of another can. In his opinion the case had been established, and he convicted the defendant, who had been before fined, in a penalty of £5 and costs. The money was paid.

Prosecution of a Large Farmer. Heavy Fine :—

Mr. Isaac Peart, of Jewin Farm, Welwyn, Herts, was summoned by the Metropolitan Dairymen's Society for selling to Mr. T. Edwards, of 35, Fonthill Road, Finsbury Park, milk which was adulterated with 17 per cent. of water. Mr. Ricketts prosecuted on behalf of the Society, and Mr. Besley defended. Mr. Edwards said he had been for the past two years in the habit of receiving churns of milk from the defendant daily at the Finsbury Park Railway Station. Finding that some of it was not pure, he communicated with the defendant, but without avail, and on July 6 a portion of one of the churns of milk was taken and, on analysis by Dr. Tidy, it was found to contain 17 per cent. of added water. Mr. Parish, the Society's Inspector, gave evidence as to taking the samples, and forwarding one to Dr. Tidy for analysis. The defendant, who said he kept over 100 cows and farmed 600 acres, swore that when the milk in question left his farm it was in the same state as given by the cows. Mr. Barstow said he considered the case fully proved, and as the defendant admitted that he was in a large way of business, he should inflict the full penalty of £20, and £5 costs.

Sale of Adulterated Milk by Boys :—

On the 11th August, a curious case of milk adulteration was before the magistrate at Lambeth Police Court. Lewis Champion, of Cambridge Villa, Avondale Road, Peckham, was summoned by one of the Sanitary Inspectors of St. Giles, Camberwell, for selling adulterated milk. In answer, a boy presented himself, and a female friend said he had sold her milk for which he was summoned. The Inspector said it was a serious case, and complaints had been made that boys were sent about the streets with milk adulterated to the extent of thirty-six per cent of water. The boy told him that his father had sent him out, and he had taken out the summons against his father, and he had left, and now sent the boy. The boy declared that he had "started" himself in business. The Magistrate asked him whether he meant that he had at his age (apparently about twelve years old) commenced business. The boy said he had, and it was explained by him that he had bought half a gallon of milk for elevenpence. The Inspector had not paid elevenpence for four quarts of milk. It was stated that there were eight quarts to a barn gallon. The Magistrate remarked that the boy was a "very young tradesman" to begin business at his age. The Inspector asked the Magistrate to grant a warrant against the father of the boy, who was no doubt keeping out of the way. The Magistrate said he could not grant a warrant against a person who had not been served with a summons. The Inspector said the father had better then be summoned. In answer to a question how so young a "tradesman" as the boy could find money to buy milk, it was stated by his female friend who accompanied him to the Court that he bought the milk out of his pocket money. The Inspector again urged upon the Court that it was a very bad case. Boys were sent about with adulterated milk with thirty-six per cent. of water, and then, when summoned, declared, as this boy had done, that he had bought the milk himself. In answer to the Magistrate, the boy said he had sold the milk as he had bought it, and mentioned the name of a dairyman. The Inspector said the tradesman whose name he had mentioned was a respectable person, whose milk had been analysed and found to be good. The Clerk of the Court suggested that the summons had better be withdrawn, and the matter brought before the Vestry of Camberwell. The summons was accordingly withdrawn.

Prosecution of Farmers. Reasonable Notice should be given of Intention to take Samples at Railway Station :—

At Westminster Police Court, Alexander Frazer and Campbell Frazer, gentlemen farmers, of Faygate, Sussex, appeared to summonses taken out by George Barham, of 28, Museum Street, Bloomsbury, charging them with selling to him, as the purchaser, milk which contained 13 per cent. of added water. Mr. Ricketts appeared for the prosecution ; and Mr. Besley, barrister, for the defendants. The prosecutor was the managing director and almost absolute owner of an association called the Express Milk Company, and the defendants entered into a contract to supply milk to be delivered at Victoria Station. On June 28 two churns of milk from the defendants' farm arrived at the station, and Mr. Maconochie, the complainant's manager, telegraphed to the defendants that a sample would be analysed, and invited their attendance. The churns were sealed up, and in the evening Parish, an officer of the Metropolitan Dairyman's Society, took samples of each, which were submitted to Dr. Corfield the analyst for the parish of St. George's, Hanover Square, who certified that they were adulterated with 13 per cent. of added water. Mr. Ricketts put in the contract by which the defendants agreed to supply pure milk, and, with the view of showing that the milk had not been tampered with since it left the defendants' farm, called a number of railway officials, who swore that it was safe and not touched while in their custody from Faygate Station to Victoria. Mr. Besley took several legal objections to the form of the summons, and denied that the defendants had watered the milk, or that it had been done on their farm. The defendants were the sons of General Frazer, and they had contracted with the plaintiff in the belief that he represented a *bonâ-fide* company, whereas the fact was that he was a speculator who he (the learned counsel) stated, had taken these proceedings merely for the purpose of advertising his milk It was practically an impossibility for the defendants to have been present at the analysis at the time stated. Mr. D'Eyncourt decided that the summonses must be dismissed, because reasonable notice did not reach the defendants to enable them to be present when the milk was sampled.

Defendants may be called as Witnesses :—

William Austin, cheesemonger, Atlantic Road, Brixton, was summoned by Inspector Baxter for selling as butter "bosh." A witness was called who said he asked for a pound of shilling butter, and was supplied with "bosh," or "animal fat" mixed with a little butter. The Inspector said he took the butter into the shop, and divided it into three parts, and told the defendant it was to be analysed, and he then said he told the person to whom he sold it that it was for cooking purposes, and not for eating. The witness denied the statement. The defendant called a witness, who said he heard some of the statement. The defendant said he sold but a small quantity, and did not wish to "push" the article in his trade. His butter was 1s. 4d. per pound, and he intimated that real butter could not be purchased at one shilling per pound. Botts, Baxter, and Box said they had purchased butter at the time for one shilling per pound. The defendant said he did very little in the article now complained of, and he denied that he had sold it as "butter." Mr. Chance advised him to do less. He imposed a penalty of 5s. and 12s. 6d. costs on the defendant. Such stuff had better not be sold. Under the new Act, defendants are competent witnesses, and the privilege does not seem to be known.

Rum 31° under proof. Ingenious Defence :—

Charles Roberts, landlord of the Sovereign public house, 61, Osnaburgh Street, Regent's Park, was summoned by William Rouch, one of the sanitary inspectors for St. Pancras, for selling, to the prejudice of the purchaser, a pint of rum which had been adulterated by water so as to reduce the strength of the spirit more than twenty-five degrees under proof. Mr. Ricketts, solicitor, prosecuted on behalf of the St. Pancras Vestry, and said that under section 6 of the new Act it was a good defence if it was shown that the strength of the rum had not been reduced more than twenty-five degrees under proof. Here the rum was found to be 6¼ per cent. less than was allowed by the statute. The defendant said the only way in which he could account for the percentage of water was that his barmaid used a measure which she had previously been rinsing, and the moisture in the measure would reduce the strength. The inspector, in answer to the magistrate, said there had never been a complaint against the house before. Samples had been had from the house, but they had always been good. The defendant remarked that if he had intended to defraud he would have done it in a different manner, for he might have sold rum to answer the same purpose that would cost 3s. less. Mr. Ricketts, in answer to Mr. Sheil, said the Vestry did not press for a vindictive penalty. Defendant was fined 40s. and 2s. costs.

NOTES OF THE MONTH.

We have received a second letter from the author of *Nature's Hygiene.* Mr. Kingzett should remember that the *book* was *sent* to us for review, and that we criticised its tendency, and not Mr. Kingzett's personal ability as a chemist. The latter point we perfectly recognise, and only regret that he should have allowed himself to issue a work which while in its title purely scientific should yet introduce the mention of a special commercial article. We have no desire to detract one iota from the purely chemical merit of Mr. Kingzett's experiments, and we hope that he will be satisfied that no personal slight in this direction was for a moment intended.

In another column we print Mr. Edge's reply to our remarks in the last number of this journal. Our readers will see that we are credited with thinking that "no milk dealer could either speak the truth or be honest." Such an idea is absurd, and we do not for a moment hold this opinion; but what we say is that, through want of technical chemical knowledge, Mr. Edge has been led in the utmost good faith to make perfectly erroneous statements, which are simply a repetition of similar charges urged from time to time by unscientific persons. If Mr. Edge were a chemist he would know that no opinion can be formed upon a milk without a quantitative analysis, and that the analyst, according to the schedule of the Act, ought to give his quantities. The words are quite plain "that it consists of parts as under;" then follows the analysis of the milk, and lastly come the "remarks," in which the inference to be drawn from the figures is stated. It is therefore clear that the charge against analysts in general of not giving quantitative results must fail. The second charge made, namely, that the analyst has a direct interest and monetary benefit from convictions, is now toned down by Mr. Edge to the fact that when called upon as a witness he has the usual fee. This is a very different state of matters, because the fee as witness being payable whether the prosecution is successful or not, the charge formerly made was evidently untenable. We would, however, point out to Mr. Edge that the Act expressly provides that to save expense the analyst need not be called, and if the Association purposely incurs this expense they have only themselves to blame. In London the attendance of an analyst in court is a thing almost unheard of. If the certificate is disputed the duplicate sample is simply sent to Somerset House, when their certificate decides the case, and no costs of professional witnesses are incurred by either side. It is therefore clear that Mr. Edge's charge against analysts of having any monetary interest in prosecutions is unjust and ought to be withdrawn unreservedly.

In his letter Mr. Edge introduces a new charge, to wit, that a milk which has been slightly watered may pass an analyst. There can be no doubt that such is the case, but at whose door does the fault lie? Unquestionably it is at that of the trade societies. When the Act passed, the Society of Public Analysts, after most careful consideration, fixed a fair standard not to be complained of by any honest dealer, but forthwith all the ingenuity and legal acumen of defending counsel was put to work to prove that in certain extreme cases milk might fall below this standard, and by continual arguments, coupled with the fact that Somerset House took for its standard an abnormally low one, it has come to this, that "pure milk" by the common limit of purity may and often does contain 10 per cent. of water if the original article *were rich*. All this suited the Societies very well until they in turn desired to use the Act against the farmers, and then, lo and behold, they object to the low standard which their own action has brought about. After all it is only human nature to wish a low standard of 8·5 solids not fat when they are defendants, then grumble when it passes as watered milk when sold to them, and then abuse analysts if they do not always use the Society's standard of 9·0 per cent.

Then, again, on the question of cream, mentioned by Mr. Edge, the milkmen have again themselves entirely to blame. The lowest honest natural fat was taken by us as 2·5, but some excuse for skimming beyond that was necessary, and therefore the theory that milk served from a can might perfectly innocently lose its fat to the extent of at least one-half, was started, and an eminent professor retained to prove it experimentally. The defence was successful, and, as an analyst has no means of knowing from whence a sample comes, it follows that milks have to be passed which on their very face bear evidence of loss of cream. This re-acts of course against the milkmen when they desire to prosecute the farmers, and then they blame the analysts instead of themselves.

The *Chemist and Druggist* for once speaks out manfully on the tincture of quinine case, and objects to the defence evidence as ridiculous, but it cannot help giving the analysts a little kick although it practically admits that in this instance at least the Public Analyst had a *raison d'être*. It says that statements like those of Dr. Browning "would hardly pass unchallenged even in the Society of Public Analysts." After all Dr. Browning's statements are simply a *reductio ad absurdam* of a style of defence on the part of the chemists and druggists which we have often had occasion to challenge and which has before been found successful on grounds very little better.

Bristol possesses an analyst whose report of the results of 20 samples has been simply ordered to lie upon the table because his appointment has not yet been approved by the Local Government Board. Surely it is a pity that such a waste of energy and money should have taken place, and the authorities should not have first seen that they had their officer's qualifications approved before sending in samples to him.

A correspondent in a contemporary says:—A poor ill-used dairyman of Ramsgate has been fined for only adding 53 per cent. of water to his milk. I presume he supplied the Cockney visitors. Last year the Margate magistrates, at the end of the season, fined a lot of milkmen for watering the skim, and it was really heart-rending to hear those men argue that if the system of persecution continued, they would never be able to make out the quantity of sky blue demanded by the visitors. They considered the Margate water nourishing stuff, and quite worth 5d. a quart.

Mr. F. W. Stoddart has been appointed Public Analyst for Salisbury, in the room of his late father.

SOOTHING POWDERS.—At an inquest held on August 3rd, by Mr. Brian, Coroner for Plymouth, an infant, aged 10 weeks, was proved to have died of narcotic poisoning after the administration of part of a powder purchased from a local druggist, and described as a "Steedman's Soothing Powder."

A dealer, at Ballynaninch, Co. Down, has been fined £2 for selling flour adulterated with oat flour, and containing fungi, as certified by Dr. C. A. Cameron, County Analyst.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
4104	H. E. Newton	Apparatus for Concentrating Acids	6d.
5102	H. R. Snelgrove	Manufacture of Gas	6d.
5310	H. A. Bonneville	Manufacture of Gas	6d.
5323	H. C. Bull	Manufacture of Gas	6d.
1880			
18	J. W. Swan	Electric Lamps	2d.
45	J. Mactear	Obtaining and Supplying Carbon	2d.
53	W. R. Lake	Production of Phosphoric Acid in Manufacture of Glass	4d.
79	R. Werdermann	Producing and Utilizing Electric Currents	6d.
91	W. R. Lake	Microphonic and Telephonic Apparatus	8d.
158	L. J. Crossley	Microphonic and Telephonic Apparatus	6d.
109	J. Kidd	Apparatus for Carburetting Illuminating Gas	6d.
147	F. Zimmermann	Tannic Acid	4d.
203	J. Clark	Developing Electric Light	2d.
225	W. R. Lake	Purifying and Refining Paraffin	6d.
263	W. L. Wise	Producing Anhydrous Sulphuric Acid	4d.
569	H. Y. Attrill and W. Farmer	Manufacture of Gas	10d.
1553	C. D. Abel	Electric Lamps	6d.
2037	W. Clark	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

Spon's Dictionary of Arts and Manufactures, Part II.; Tables for Analysis of a Simple Salt by A. Vinter; Contributions to the Chemistry of Bast Fibres, by E. J. Bevan and C. F. Cross, The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The *Cowkeeper and Dairyman's* Journal.

THE ANALYST.

OCTOBER, 1880.

ON THE MANUFACTURE OF SUGAR FROM THE SUGAR CANE.

By R. H. Harland, F.C.S.

The art of manufacturing and refining sugar has now attained to the rank of the second industry in the world. The two sources from which the supply of sugar is derived are the beet root and sugar cane—the one growing in Europe, the other requiring the heat of a tropical climate to bring it to maturity. Many other plants also have the property of producing crystallizable sugar, identical in chemical composition with that prepared from the beet or cane; notably the sugar maple (*Acer. saccharum*), from which a large quantity of sugar is manufactured in Canada, the United States, and Borneo, but the supply is now gradually falling off on account of the destruction of the maple forests.

The sugar obtained by the natives of Bengal and Siam from the various species of palm is, on account of the crude way in which it is manufactured, of very inferior quality, and is mainly consumed in the countries where it is grown. The juice of the Nipah palm (*Nipa fruticans*) is almost equal in saccharine richness to that extracted from the cane, with the advantage that it is much cleaner, and contains no coloring matter or chlorophyll, the vegetable matter being easily precipitated, giving a liquor as clear as spring water. This species of palm flourishes near the sea, or on the edges of brackish pools, and takes up a large quantity of salt, which makes its appearance in the juice in varying quantities; sufficient, in some cases, to give the liquor a decidedly saline taste. Were it nor for this drawback, I have no doubt that a large quantity of excellent sugar would be obtained from this source.

Since the time when the beet root was first experimentally cultivated for sugar, it has, by careful cultivation become the source of nearly half the total quantity of sugar which is produced at the present day. It is not, however, entirely due to the agriculturalist that beetroot sugar is able to compete so successfully with cane, but a great deal of the success attending its production is due to the fact that the manufacturer called in the assistance of chemistry and chemists, to enable him to decide on the most scientific and profitable method of working; and although the average quantity of crystallizable sugar contained in the beetroot juice is only half that which is contained in the juice of the sugar cane, and other impurities are likewise present which have to be removed previous to the evaporation of the liquor to form the best crystals, yet the quality of the product is superior to and commands a much higher price than the raw cane sugars which are imported to this country from the colonies, and which require to be refined previous to consumption. Of course, Demerara sugars, and also sugars from other countries where the vacuum pan is in use, compete favorably with the refined article, either on account of their peculiar color or some other distinguishing mark which renders them pleasing to the eye, and even, perhaps, from the fact of their containing a proportion of uncrystallizable sugar (molasses), they are more palatable to the public, who, for some purposes, prefer the impure article to the pure loaf sugar.

The reason for the difference in quality between the colonial cane sugar and continental beet sugars is easily found when we take into consideration the difference in the mode of manufacture, and also the fact that the extraction of sugar from the beet has been investigated scientifically by some of the leading continental chemists, and chemistry and proper chemical supervision rule all the operations from the manuring of the root to the time when the sugar is turned out of the factory in an almost chemically pure condition. That this is so, is proved by the fact that almost every chemical journal issued contains the results of some research or enquiry into one or other of the important operations connected with its manufacture or the products produced therefrom; and, further, every manufacturer knows so well the great importance of chemical analysis, that hardly one beetroot sugar factory is without a chemist. Now, in the case of the sugar-cane planter: he begins by manuring his land with some compound which is very likely to be quite unsuitable for the variety of cane which he wishes to grow; perhaps he does not consider it necessary to trash his canes or clean them so as to allow the rays of the sun to exert their action on the cane, and assist in producing the saccharine matter; but leaves them to grow as best they may until the time comes for cutting and extracting the sugar; in many cases the boiling-house is unable to keep pace with the cutting, from bad weather or other causes, and a stock of canes are standing at the mill, and perhaps remain exposed to the atmosphere for some days, but this is not of so much importance, as I shall afterwards show (except in the case of canes that have been grown on land that is poor in lime salts: in this instance the juice is generally very acid, and rapidly undergoes fermentation even before it is expressed from the canes), as a practice which I have frequently seen followed of leaving a portion of the juice to stand all night, or cleaning and evaporating the juice to a density of 18° to 20° B., and allowing it to stand—say for 8 to 12 hours—to settle, thus causing fermentation to set up, and consequent loss of crystallizable sugar and formation of molasses; in fact, in many boiling-houses the operations are conducted entirely by rule of thumb, and the overseer in charge knows little or nothing about the composition or properties of the substance which he is manufacturing.

Of course these remarks do not apply with the same force to estates which work with the triple-effect and vacuum pan, but even in many of these cases mistakes are made, and losses of sugar occur which would be prevented and remedied if a system of analysis were carried out. Occasionally, syrups are allowed to stand too long a time before re-boiling, under the supposition that on account of the density they will keep any length of time, but in hot climates the temperature is so favorable to fermentation, that in syrups of a density of 38° to 40° B. crystallizable sugar is converted into glucose, although the appearance of the surface of the liquor would not seem to indicate that any chemical change was taking place; indeed, it is not even necessary that the sugar should be in the form of syrup to allow of this change taking place, for low sugars will form molasses and drain rapidly when heaped in bulk or stowed in a ship's hold, owing to rapid conversion of crystallized sugar into glucose by the action of fermentation. This is a well known fact, and the loss of weight in cargoes of raw sugar is constantly being determined; but the actual loss of crystallizable sugar caused by drainage and deterioration, and formation of probably not less than from 2 to 4 per cent. more glucose in the raw sugar than it contained when shipped, is a fact that, up to the present time, has been lost sight of. In one instance, where a *ry sugar, containing* 88 per cent. crystallizable sugar, 3 per cent. uncrystallizable, and ·92 ash, was stored for six months in a warehouse in Manila: at the end of that time the bags were quite wet and sticky, and molasses was draining away in considerable quantities; the sugar then showed a loss of 6 per cent. in crystallized sugar, and formation of nearly 5 per cent. of glucose, besides being very acid to litmus paper. A sample of Taal sugar, kept in a well stoppered bottle in the laboratory for one year, showed a decrease of 1½ per cent. in the crystallizable sugar, and a corresponding increase in the amount of glucose. Another very common mistake in sugar houses abroad consists in sending molasses to the distillery before the whole of the sugar has been obtained; these molasses should be re-boiled to a jelly, and allowed to crystallize slowly in tanks, by which means a further supply of sugar is obtained which would otherwise have been converted into alcohol.

It will be seen from what has already been said, and it is also a well-known fact, that a great waste of sugar goes on in the process of open-air boiling, and many mechanical contrivances have been invented in order to obtain the sugar in a solid form at as low a temperature as possible; the best of these, and the one which is now adopted in all countries that send to England and elsewhere sugar suitable for direct consumption, is the vacuum pan; but in many sugar-producing countries the vacuum pan has not been adopted, either from want of capital, or from a conservative tendency on the part of the planter, who prefers to go on spoiling his sugar by open-air boiling to adopting machinery which would in a very short time pay for itself in the quality and increased price of the article produced.

In the colony of Queensland, which in point of time is one of the youngest of the sugar-producing countries but which has gone far ahead of older settlements, a high-class vacuum pan sugar is produced polarizing 97 to 98 per cent., from juice of which the following analyses are specimens:—

CANE JUICE EXPRESSED FROM CANES GROWN IN THE MARY DISTRICT, QUEENSLAND, AUSTRALIA.

	Gingham Cane.		China Cane.		Mixed Samples from various species of Cane.
Baumè at 15·5° C	11·5°	..	10·5°	..	11·6°
Crystallizable Sugar	19·50 °/ₒ	..	16·40 °/ₒ	..	18·30 °/ₒ
Glucose	·25	..	·41	..	·45
Ash (Soluble Salts)	·70	..	1·11	..	·37
Other organic matters	1·17	..	2·51	..	3·14
Total solid matter	21·62		20·43		22·26

These juices all yield very good sugar, giving on the average of one season's work 1·25 lbs. of sugar per gallon of juice at 10° B., of which 65 to 70 per cent. is nearly white crystals, and compares very favorably with colonial refined sugar; the remaining quantity is sugar of a lower grade, and obtains a ready sale as "pieces." This result is obtained without the use of bone-black, and the only method of purification adopted is the plan of precipitating the vegetable "feculences" with milk of lime, and removing them by skimming as they rise to the surface of the liquor when heat is applied.

The manner in which these juices behaved in the boiling-house was very different, great difficulty being experienced in the treatment of the China cane juice, the sugar produced being worse in quality and deficient in quantity when reduced to the standard of 10° B. as compared with the juice from the Gingham cane which was easily converted into sugar of excellent quality; the reason of this is apparent from the analyses, the China cane containing a larger quantity of ash or soluble salts which have the property of converting crystallizable sugar into glucose during the operation of boiling. It is curious to note the difference in quality between these two samples of juice, especially as the two species of cane were grown on one plantation under similar conditions, it is evident that the China cane has the property of abstracting from the soil a larger proportion of mineral salts, and these salts, when soluble, go greatly towards explaining low yield of sugar and large quantity of molasses; these analyses show the necessity of studying the compositition of the juice from the various species of cane so as to determine the most suitable class of cane to grow, and also the kind and proportion of manure to employ so as not to increase more than is absolutely necessary the quantity of those salts which are so detrimental in the process of manufacture to the quality and quantity of the sugar produced.

The Philippine Islands export large quantities of raw sugar. The production is said to amount to nearly 200,000 tons per annum, but none of the sugar exported is of good quality, as the following analyses of dry sugars will show :—

	Yloilo Sugars, No. I.	No. II.	No. III.	Zambales Imitation Yloilo.
Crystallizable Sugar	85·30	81·60	78·60	82·10
Glucose................	5·80	8·30	9·10	7·70
Ash	·94	1·02	1·90	2·00
Moisture	5·06	6·06	5·56	4·20
Unknown organic matter.	2·90	3·02	4·84	4·00
	100·00	100·00	100·00	100·00

	Cebu Sugar, superior.	Cebu Sugar, current.	Pampana (new Sugar), unclayed.	Laguna Sugar.	Taal Sugar.
Crystallizable Sugar..	81·20	71·00	78·40	82·70	70·6
Glucose	7·80	10·90	10·60	5·70	12·0
Ash	2·15	2·56	1·80	1·34	3·5

The Zambales sugar is the same number by Dutch Standard as No. 1 Yloilo. The proportion in which these sugars are produced is 1/8 of No. 1, to 3/8 of No. 2, to 4/8 of No. 3. The insoluble organic matter in these sugars is generally less than ·2 per cent., and is of a very slimy nature; the remaining soluble unknown organic matter is the amount which it is necessary for the bone-black to absorb. Of course all these sugars are produced by a similar arrangement to the copper-wall, and in some districts the destruction of sugar by burning in the process of evaporation, is exceedingly large. The cane juice expressed from the ripe canes is of fair quality, and will compare favorably with the Queensland samples. A sample from the Taal district, which is extremely fertile and well suited for sugar plantations, showed to analysis :—

Crystallizable Sugar	18·30
Glucose	·10
Ash	·30
Other organic matter	3·25
	21·95

With a vacuum pan and proper machinery a juice of this quality should yield excellent grocery sugar. It would hardly be of such good color as the Queensland sugar on account of the large proportion of green coloring matter (chlorophyll), a portion of which was not precipitated by neutralization with milk of lime, but the sugar would compare very favorably with crystallized Demerara. At the present time the quality of the sugar produced from this juice corresponds to the analysis of Taal sugar given above, the article being fit for nothing but brewing black beer.

In one district in Luzon, where the cane grows luxuriantly often to a height of 12 feet, and one stool produces four or five canes, the crushing season lasts considerably longer than in other districts, and the sugar produced is of superior quality. The soil being extremely fertile, a sample was analysed, and showed the following results on the dried sample :—

CANE SOIL FROM CAMARINE SIN, LUZON.

Silicious matter	53·39 °/ₒ
Alumina	13·16
Oxide of Iron	4·80
Oxide of Manganese	·10
Oxide of Magnesia	·42
Potash and Soda, as Chlorides	1·14
Carbonate of Lime	1·60
Sulphuric Acid	·09
Phosphoric Acid	·25
Carbonic Acid	Traces.
Organic and Volatile Matters	25·05
	100·00
Moisture in Sample before drying	6·79 °/ₒ

Unripe canes invariably contain a large quantity of glucose, which is probably converted in the process of ripening into crystallizable sugar.

The following analyses are of canes known to be in an unripe condition and juice from them:—

UNRIPE CANES.

Crystallizable Sugar		10·00
Glucose		2·80
Ash		·74
Soluble Ash	·32	
Woody Fibre		12·26
Water		74·20
		100·00

JUICE FROM UNRIPE CANES.

Crystallizable Sugar	8·60 °/ₒ	7·76 °/ₒ	7·24
Glucose	3·10	2·30	2·50
Ash	·21	·25	·34
Unknown Organic Matter	1·27	1·74	2·89
Total Solid Matter	13·18	12·05	12·97

In order to ascertain whether the juice of the cane underwent any decomposition when the canes were kept for some time previous to crushing, the following experiments on unripe canes were made. These canes were selected, as it was thought probable that they would deterioriate more rapidly on account of their acidity, and the fact of their containing less saccharine matter.

Two plants were selected, each having two healthy canes growing from the one stool; the juice from one of these was expressed and analysed immediately, the other was put aside in the laboratory for eight days, at the expiration of which time the juice was expressed and submitted to analysis.

FIRST EXPERIMENT.

Weight of Cane	1 lb. 10¼ oz.	2 lbs. 8¼ oz.
Loss of Weight in 8 days	..	4·75 oz.
Equals per cent.	..	11·8 per cent.
Baumè of Juice	5½°	5¾°
Crystallizable Sugar	5·99 per cent.	7·33 per cent.
Glucose	1·70	1·50
Ash	·30	·32
Unknown Organic Matter	2·27	1·99
Total Solid Matter	10·26	11·14
Reaction	Slightly acid.	Slightly acid.

SECOND EXPERIMENT.

Weight of Cane	2 lbs. 1¼ oz.	2 lbs. 6¼ oz.
Loss of Weight in 8 days	..	4·7 oz.
Equals	..	12 per cent.
Baumè	5½°	5½°
Crystallizable Sugar	8·17 per cent.	6·54 per cent.
Glucose	1·90	1·40
Ash	·26	·24
Unknown Organic Matter	·87	2·34
	11·20	10·52
Reaction	Slightly acid.	Slightly acid.

These results show that no fermentation of the juice had taken place during the time the canes had been exposed after cutting; in fact, the singular result of the glucose being less in the exposed samples, would seem to indicate that a ripening action had been going on; these results must be taken for what they are worth, but they would certainly seem to indicate that canes could be kept and transported long distances without undergoing loss of crystallizable sugar; but this, of course, only applies to sound canes, and the result might be quite different in cases where the rind of the cane was cracked or eaten into by rats.

ADULTERATION OF FOOD IN CANADA.

The following Annual Report of the Commissioners of Inland Revenue has just been issued. It forms the introduction to a volume of 83 pages containing the detailed reports of the four analysts—Messrs. Ellis, Edwards, La Rue, and Fraser.

The reports, as usual, set out in full the name of each vendor convicted, with the details of the adulteration. It includes, also, the full analysis of every sample of milk submitted to the analysts.

INSPECTION OF FOOD.

To the Honourable
The Minister of Inland Revenue.

Sir,—I have the honour to submit my Fourth Report respecting the analysis of Food, together with the reports of the analysts appointed under the Act, and tabulated statements prepared in this Department of the results of the analysis of the various samples submitted to them.

1. The following statement is a summary of the whole number of samples analyzed.

Name of Sample.	Genuine.	Adulterated.	Doubtful.	Total.
Allspice	6	10	..	16
Baking Powder	19	5	..	24
Bread	23	1	..	24
Butter	146	67	14	227
Cassia	..	1	..	1
Cloves	7	9	1	17
Cinnamon	3	16	..	19
Ginger	5	6	..	11
Guano	..	5	..	5
Honey	2	..	..	2
Mace	5	1	..	6
Milk	167	76	8	251
Nutmegs	3	..	..	3
Pepper	22	21	1	44
Potted Meats and Fish	37	..	1	38
Self Raising Flour	16	1	..	17
Sugar	81	9	11	101
Tea	52	6	6	64
Water	25	1	..	26
Total	619	235	42	896

2. From the above it will be seen that eight hundred and ninety-six samples have been analyzed, two hundred and thirty-five, or a little more than twenty-six per cent., were adulterated, and forty-two are returned as doubtful.

3. By the following table it will be seen that a perceptible improvement has taken place. In 1876 the percentage of adulteration was 51·66; in 1879 it has fallen to 26·22 per cent.

Year.	Genuine.	Adulterated.	Doubtful.	Total Number Analyzed.	Percentage of Adulteration.
1876.................	87	93	..	180	51·66
1877.................	241	247	..	488	50·61
1878.................	523	271	19	813	33·33
1879.................	619	235	42	896	26·22

4. The analysis of twenty-four samples of baking-powder shows that injurious chemicals have not been used to any great degree, as only five samples out of the twenty-four were found to be adulterated.

5. The important article of bread appears to be fairly free from adulteration, for out of twenty-four samples analyzed but one was adulterated.

6. Two hundred and twenty-seven samples of butter were analyzed during the year. Of these seven were adulterated and fourteen were classed as doubtful. The adulterations being principally salt and water; but in a number of cases the butter was rancid, probably owing to carelessness in packing.

7. Of one hundred and seventeen samples of condiments analyzed, sixty-four were adulterated and two were of doubtful charcter. The adulteration of this class of food is still very large, but there has been a gradual improvement, as the following table will show:—

Year.	Genuine.	Adulterated.	Doubtful.	Total Number Analysed.	Percentage of Adulteration.
1876.................	5	39	..	44	88·63
1877.................	24	83	..	107	77·57
1878.................	26	108	..	134	80·59
1879.................	51	64	2	117	54·70

8. Two hundred and fifty-one samples of milk were analyzed. Of these seventy-six, a little more than thirty per cent., were adulterated, and eight samples were returned as doubtful. This shows an improvement of ten per cent. upon last year's analysis.

9. Of one hundred and one samples of sugar analyzed nine were adulterated and eleven doubtful.

10. Of sixty-four samples of tea analyzed six were reported as adulterated and six doubtful.

11. Of twenty-six samples of water analyzed only one is returned as bad.

Respectfully submitted,

A. BRUNEL,
Commissioner of Inland Revenue.

DEPARTMENT OF INLAND REVENUE,
December, 22nd 1879.

AN IMPROVEMENT IN THE MODE OF ESTIMATING NITRATES BY CRUM'S METHOD.

By Alfred H. Allen.

I have, of late, been in the habit of employing a nitrometer for the estimation of the nitrates and nitrites in water. Half a litre or 250 c.c. of the sample is evaporated almost to dryness and transferred to the tapped limb of a nitrometer filled with mercury, the total volume of liquid, *plus* the rinsings, being restricted to 2 c.c. Concentrated sulphuric acid is then run in till the total bulk of the liquid is 5 c.c., when the tube is agitated as usual, the open end of the nitrometer remaining firmly clamped in the support. In the ordinary course of working, it would now be necessary to allow the whole of the mercurial froth to subside, adjust the level of the mercury in the two limbs, read off the volume of gas, observe the temperature and barometric pressure, and calculate the observed measure of gas to the standard conditions. Instead of doing this, I employ a double nitrometer-stand, and make a test experiment, side by side with the sample. The standard solution I employ is one of nitrate of potassium, containing 5·055 grammes of the salt per litre. 20 c.c. of this solution contain ·1011 of KNO_3, and yield 23·58 c.c. of nitric oxide gas, measured at 15·5°C (not 0°C.) and 760 m.m. pressure. Care is taken to make the volume of liquid and acid in the standard tube identical with that in the experimental nitrometer. On the surface of the mercury in the open limb of each nitrometer, I pour 5 c.c. of a mixture of three volumes of concentrated sulphuric acid with two of water, so as to have a liquid of the same density and measure as that in the tapped limbs.

After the completion of an experiment, the level of the *aqueous* liquids in each limb is made identical. By operating in this manner it becomes unnecessary to wait for the subsidence of the persistent mercurial froth which is often produced, and the reading may be taken as soon as the evolution of gas has ceased. As the temperature, barometrical pressure, and tension of aqueous vapour in the two nitrometers are necessarily identical, it only remains to compare the volume of gas yielded by the sample with that obtained from the 20 c.c. of standard nitre solution, in order to ascertain the amount of nitrates, &c., in the water.

20 c.c. of nitre solution equal ·054 grammes of N_2O_5.
" " " " ·062 " " NO_3.
" " " " ·014 " " N.

In an actual experiment, I obtained from a quarter litre of drinking water 27·0 c.c. of nitric oxide, while the gas from 20 c.c. of the nitre solution measured, under similar conditions, 23·9 c.c. Hence

$$23{\cdot}9 : 27{\cdot}0 = 0{\cdot}054 : 0{\cdot}061 \quad N_2O_5.$$
$$23{\cdot}9 : 27{\cdot}0 = 0{\cdot}014 : 0{\cdot}0116 \quad N.$$

These figures work out to 17·08 grains per gallon of N_2O_5, and 3·25 grains of N.

In practice it is not necessary to make a test experiment every time. If the tap of the nitrometer be tight, the standard measure of gas obtained from the nitre solution may be kept for an indefinite period.

Test experiments which I have made with solutions of nitrates have shown that the method is capable of very considerable accuracy, and might probably be found very convenient for the assay of commercial nitre and nitrate of soda.

Crum's process is one which is well known to give good results, and the nitrometer has been applied to it independently by other chemists; but the method of working above described adds so much to the rapidity and convenience of the process in actual practice, that it appeared desirable to call attention to it.

ON A SUBSTITUTE FOR ALUM IN MAKING BREAD.

By C. Estcourt, F.I.C.

About six months ago my attention was called to the use, by bakers, of a compound (in a liquid state) which, it was said, would replace alum completely. As is the case in connection with all trade secrets, there was a difficulty in obtaining any definite information which would enable one to form a judgment upon the matter. It happened, however, that about the time named I received from a baker a small bottle of this liquid, together with a loaf in which I was informed it had been used. The loaf, upon analysis, gave alumina equal to 21 grains alum per 4 lb. loaf; so I drew the not unfair inference that some ingenious person had introduced to the baking trade some compound of alumina, not alum itself, and could therefore assert that no alum had been used in the compound.

A qualitative analysis of the liquid showed Al—Ca in small quantity, Mg—NH_3—Na in large quantity, whilst the acids present were found to be phosphoric, HCl. and H_2SO_4, but principally H_2SO_4, which it was assumed was used to keep the phosphates in solution.

Upon the evidence of the Al found in the loaf I gave the opinion that the use of the liquid would be improper and unsafe.

Since then, upon various occasions, I have received samples of liquid said to be (in the principal constituents) like the one I had examined, but said to be so improved as to contain no alumina. All these samples, however, differed one from another so much, that I advised the persons consulting me it was unsafe to use them without guarantee that no fresh changes would be made in them by the vendor. During the past month I have again had submitted to me for examination, by a large baker here, a sample of the liquid, together with a loaf in which it is said to have been used. The sample is now declared by the inventor to be perfection, and certainly practically gives no alumina in bread in which it is used.

I give below the result of quantitative analysis of the liquid :—

Sp. gr. at 60 = 1174.

	In 100 parts by measure.
Free Phosphoric Acid, calculated as $H_2P_7O_8$.	14·58
Magnes. Pyrophosphate	6·94
Ditto Sulphate	6·39
Sodium Chloride	traces.

The compound is therefore mainly magnesium phosphate kept in solution by phosphoric acid.

The bread sent was said to have been made from poor English flour, which would not, owing to deficiency in gluten, have made a presentable loaf without alum. It was found to be beautifully white, firm, and yet well ærated. The air spaces of the loaf, shown when it was cut through, were very numerous and of a uniform size. The total amount of alumina found in it equalled rather less than 10 grains of alum per 4 lb. loaf, which, as will be remembered, does not much exceed the quantity allowed for by some analysts as being naturally present.

Whether or not such a compound can be safely used in bread is a question of vital importance, both to the general public and the baking trade. If the compound is declared by competent medical authorities to be innocent in its results in the small quantities used, there is no doubt it will be a great boon. Wet harvest times result in large quantities of wheat, which wheat, when ground, cannot by itself be made into presentable food for man without the use of the admittedly injurious drug—alum. Thus this quality of wheat is not available for use by bakers who prize a good name; but if the use of this compound can be proved to be innocuous it would render possible the use of such flour to the mutual advantage of both the public and the agriculturists—the one obtaining cheaper bread, and the other being saved from that partial ruin which is so often the result of a bad harvest. I am making experiments as to quantities used, and will give the results in a future paper.

ABSTRACTS OF PAPERS READ BEFORE THE BRITISH PHARMACEUTICAL CONFERENCE AT SWANSEA.

Determination of the Strength of Alcoholic Solutions of Chloroform.

Report on Commercial Specimens of Sal Volatile and Chloric Ether.

By J. C. Thresh, F.C.S.

Mr. Thresh had sent a letter to about 100 chemists, including the heads of most of the best-known dispensing establishments, asking them what they were in the habit of dispensing and retailing when chloric ether (eth. chlor. or sp. eth. chlor.) and sal volatile (sp. ammon. co. or sal volatil) are prescribed or asked for.

The replies showed that 27 firms used sp. chlorof. B.P., 11 used Duncan's chloric ether only, 14 used a solution of chloroform in alcohol stronger than the B.P.; 6 others who replied used special products of their own.

Respecting sal volatile, 44 employ sp. ammon. arom. B.P., exclusively, both in dispensing and retailing; 6 use sp. ammon. co. P.L., 1836; 6 use special preparations of certain makers. Many chemists, the author added, invariably use sp. ammon. ar. B.P., for dispensing, but retail special preparations as sal volatile.

Mr. Thresh had also obtained samples of chloric ether and sal volatile from manufacturers or large wholesale houses, with three from retail houses.

All the firms to whom he wrote sent two or more samples, in many cases with replies explaining what course they usually followed under the circumstances. Many, for chloric ether, supplied Duncan's preparation; others "special distilled products;" others the B.P. sp. chloroformi; and others, solutions of chloroform in spirit, stronger than the B.P. preparation. The samples obtained were 20 in number, sp. gr. from ·861 to ·922, and in percentage of chloroform (by volume) from 2 to 12¼ per cent. He was rather surprised at the small percentage of chloroform contained in the distilled "chloric ethers.' There seems to be an impression abroad that this preparation, though more miscible with water than the B.P. sp. chloroformi, is richer in chloroform. This is a fallacy. The preparation which so many understand to be intended when "chloric ether" is prescribed contains only from 2 to 3 per cent. of chloroform, although, judging from its specific gravity (which has deceived so many), it would contain 7 to 9 per cent.

With regard to sal volatile Mr. Thresh found that with perhaps one exception, every wholesale house made a sp. ammon. co., besides the B.P. sp. ammon. aromat.

His examination of the samples sent him proved that the special preparations varied in specific gravity from ·840 to ·954, and the percentage of ammonia from ·813 to 2·326. He was not surprised to meet with a good deal of variation in these articles, but he thought it was unsatisfactory that the samples of B.P. should also prove very different in their chemical characters. Among these the specific gravity ranged from ·865 to ·894, and the percentage of ammonia from 1·067 to 2·849. It was also found that there was no ratio whatever as to the proportion of ammonia present in the free form, or as carbonate.

Restoration of Discoloured Syrup of Iodide of Iron.

By T. B. Groves, F.C.S.

The author agrees with other writers that this syrup, if made according to the British *Pharmacopœia,* with pure sugar will keep fairly well, so that well-accustomed dispensing establishments fail to see any difficulty in the matter. But those who perhaps are not called upon to dispense the article once in a month often find on searching the cupboard that the syrup without some treatment is not presentable.

The discoloration of syrup of iodide of iron is doubtless due mainly to the presence of free iodine; when turbidity is present there is probably also a basic persalt of iron in suspension which adds to the effect. To get rid of both of these it is only necessary to dilute the syrup with say a third of its volume of water, to boil briskly for a few minutes, then filter through paper, and finally reduce by evaporation to its original bulk. The syrup will then have resumed its original appearance.

The strength of the preparation will not have been materially altered by this treatment, for it takes a wonderfully small quantity of iodine in the free state to colour a large amount of liquid. This treatment by boiling was not new. "It had been suggested," Mr. Groves said, "by some writer whose name I have unhappily forgotten, but whose useful, though often unused, suggestion has not escaped me."

Mr. Groves had made some experiments with the object of avoiding the delay attendant on the process already mentioned.

When a persalt of iron is brought in contact with a soluble iodide, the salt is reduced to the proto condition, and free iodine is eliminated. It was at one time thought that under these circumstances a per-iodide was formed, but Mr. Squire, jun., some years since proved conclusively that such was not the case by showing that the colour could be removed from such a liquid by simply shaking it with an ordinary solvent for iodine, such as benzine or chloroform. However, if to such a liquid containing iodine in solution, caustic potash or soda be added, precipitation of ferric oxide will result, and the iodine will combine with the base of the precipitant. Applied to a discoloured syrup of iodide of iron the process does not answer, and that probably because the sugar exercises a solvent action on the precipitated oxides. In fact, it is after filtration more discoloured than ever.

Mr. Groves had formerly pointed out the effect produced by the presence in the syrup of a trace of phosphoric acid, which, by seizing at the moment of its formation the per-oxide of iron and rendering it insoluble, effectually prevented the reaction ending in the elimination of free iodide that would otherwise have resulted. Syrup, even dilute, would keep for years after being so treated, but of course one gets instead of the discolouration the slight turbidity occasioned by the deposit of perphosphate of iron; this, however, being colourless and easy of removal by deposit or filtration, is of but little moment. Addition of phosphoric acid to syrup already discoloured is of no avail; the mischief has been done, and no persalt remains for it to act upon. If, however, previous to the addition of the acid, a few drops of liquor potassæ be stirred into the syrup the colour disappears almost immediately, and, the acid being in slight excess, will not again return.

Thus he found by experiment that when to half a fluid ounce of syrup discoloured by one drop of liquor ferri per-chloridi, he added enough liquor potassæ (the amount would vary according to the acidity of the syrup) to produce a distinct greenish colouration, the further addition of two drops of dilute phosphoric acid restored the syrup to its original tint.

Mr. Groves prefers this method to the well-known use of hyposulphite for this purpose, though he expected it would be regarded as hateful and unorthodox by some.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—I notice in the July number of The Analyst you give the analysis of some canned tomatoes. You say "both are preserved in water," and give the percentage of solid matter present as "5·52." I think you are mistaken as regards the water. No water is added in canning tomatoes in this country. The main trouble with the canners is the excess of juice contained in the tomatoes.

I have just determined the amount of water in a tomato selected as an average. It was perfectly ripe, and when skinned and cored weighed 127·5 grams. On drying, it left a residue of 7 grams of solid matter, or 5·49 per cent., a result sufficiently near your own figures.

Having just visited one of the largest factories about, you may be interested in a description of the process used.

The tomatoes are raised in the surrounding country here—chiefly in Arlington and Belmont, which lie about six or seven miles north-west from Boston. The kind preferred at present are known as the Boston Market; these are a smooth, compact tomato, weighing from 150 to 200 grams; they are very solid being well filled with meat and very few seeds. These are brought in daily and sold to the factories. At the factory they are emptied a bushel at a time into a wire basket, and then scalded by dipping into a tank of boiling water. They are then removed to a large table, when they are sorted into firsts and seconds only, the ripest being packed as firsts. They are then measured out into pails holding about a peck each, and passed on to the skinners who carefully skin and core them. They are then ready for packing. The cans are filled by hand, the tomatoes being packed as closely as possible into the can. It is found at this stage of the operation that the juice is present in excess and a considerable portion of it is thrown away. No water is ever used, as the tomatoes furnish more than enough. After the cans are filled to within an eighth of an inch of the top, the lid is placed upon them and soldered fast. A small hole is then punched in it, and the cans are placed in a hot bath until steam issues from the hole; they are then removed from the bath and allowed to cool slightly and sealed; they are then returned to another bath in which they are boiled from 30 to 45 minutes; from this bath they are removed to a cooling room. Next morning, when cooled, they are stacked. At the end of the packing season the cans are examined and those which have spoiled are rejected. The condition of a can can almost always be told from an examination of the outside. A can in good order has the ends concave. If, on the other hand, the ends are convex, it is almost certain that the can is spoiled.

Yours respectfully,

Boston, Mass., August 23rd, 1880. S. P. SHARPLES.

REVIEWS.

Tables for the Analysis of a Simple Salt. For use in School Laboratories.

By A. Vinter, M.A. London: Longmans, Green & Co.

This little pamphlet gives in its first pages the more simple and characteristic tests for the metals and basic radicles, following which are a series of tables for the detection of bases and acids.

Although this work might have been written with ease by any fairly good chemical student with a text-book of qualitative analysis before him, yet it certainly does contain errors that even a student would hardly have made. For instance, under "Iron," after heating the salt with Na_2CO_3 and KCN upon charcoal, the following test is given:—"Dissolve the powder in $HNO_3 + HCl.$; add to the solution a solution of ferrocyanide of potassium and observe the deep blue precipitate." The presence of "aqua regia," together with ferrocyanide of potassium is certainly calculated to give an unreliable result. Under "examination of solution for acid." "Calcium chloride precipitates." "In neutral solution." *Carbonic, white, soluble in* acetic acid." We do not know of any *soluble* carbonate that gives a *neutral* solution. Other instances might be given that would certainly mislead the examiner of a "simple salt."

We have already quite sufficient works upon qualitative analysis; but should the subject be split up into a number of small branches, and each of these have works especially devoted to their attention (even supposing them to be free from error) we fear that our bookshelf will become filled with a mass of useless material.

> "There have been many chemistries of late,
> For now-a-days each chemist writes a book;
> Some have a lucky, some a luckless fate."

Contributions to the Chemistry of Bast Fibres.

By E. J. Bevan and C. F. Cross. Manchester: Palmer & Howe, Princess Street.

This work is printed from a paper read before the Owen's College Chemical Society and gives the results of a carefully conducted research, more especially upon jute.

The preparation and estimation of pure cellulose in the fibre occupies a great portion of the paper. Several methods were employed: Schulz's, with dilute HNO_3 and $KClO_3$; Müller's, by treating the fibre with bromine water; and a process devised by the authors, which seems to have been the simplest and best. The jute was boiled in weak alkali and exposed in the moist state to the action of chlorine; the chlorinated fibre plunged into a boiling solution of sodium sulphite, and then into a boiling solution —1 per cent.—of NaHO. Pure cellulose was thus obtained with a single chlorination, giving a higher yield by about 3 per cent. than the other methods, and the fibres were less broken. Chlorine forms a yellow compound, soluble in alcohol, and glacial acetic acid, from which it is precipitated by water. It is coloured violet by ammonia; with sodium sulphite "the orange yellow slowly gives place to a magnificent magenta of great purity." It dissolves in concentrated sulphuric acid, and has the following formula: $C_{19}H_{18}Cl_4O_9$. A body giving the same reactions was prepared from Esparto. Other products were obtained and analysed a carbohydrate reducing Fehling's solution, &c.

This is a very interesting paper, and it may become of much value when the authors have finished their research, and applied their methods to the numerous other vegetable fibres now in general use.

LAW REPORTS.

Milk Certificate should state whether any Change has taken place in constitution of Sample:—

At Lambeth, a milk dealer named Martial, carrying on business in Waterloo Street, Camberwell, appeared to a summons taken out by the Vestry of Camberwell for selling adulterated milk. Mr. Massey, 316, Camberwell New Road, for the defendant, said he had to make an objection which he thought his Worship would agree was fatal to the case being proceeded with. According to the 18th section of the Act a certain form of certificate was to be given by the analyst, and his Worship in the schedule of the Act would find the following words appended: "In the case of a certificate regarding milk, butter, or any article liable to decomposition, the analyst shall specially report whether any change has taken place in the constitution of the article, that would intefere with the analysis." The certificate of Dr. Bernays produced merely stated the milk was adulterated to the extent of 8 per cent. of added water but did not report as required, and he (Mr. Massey) contended that the certificate was not sufficient, and the summons must be dismissed. Inspector Mackay, on the part of the prosecution, said such an objection had not before been raised. Mr. Saunders said that might be so. He was of Mr. Massey's opinion, and therefore dismissed the summons. Mr. Massey asked for costs, but Mr. Saunders declined to grant any, on the ground that the case had not been heard on its merits. Mr. Mackay declined the risk of an adjournment.

Skimmed Milk.—Large Profits and Small Fines.

Richard Wright, milkseller, of Handsworth, was summoned, at the instance of Mr. Horder, Inspector under the Food and Drugs Act, for selling adulterated milk. The defendant said he sold the milk for Mrs. Bullock, but it was proved that he bought the milk, which was skimmed, from Mrs. Bullock's bailiff at 3½d. per gallon, and sold it to Mr. Horder's assistant at 4d. per quart. The analyst's certificate stated the milk to contain 17 per cent. of added water. The defendant was fined 5s. and £3 16s. costs, with the alternative of one month's imprisonment.

A Milkman Eight Times Fined:—

At the Manchester City Police Court, on the 25th ult., Richard Melling, farmer, Crowcroft Farm, Levenshulme, was summoned for selling milk which had been adulterated with water. Mr. Rook, Superintendent of the Corporation Nuisance Department, prosecuted, and Mr. Cobbett appeared for the defence. Inspector Sherwin deposed that he purchased a quart of defendant's milk on Sunday, the 1st August, for analysis. Mr. Estcourt, the City Analyst, stated that the milk contained 14 per cent. of added water. Mr. Cobbett said the defence was that just before the inspector asked for the milk the defendant's supply had run short. In order to furnish the rest of his customers with milk, a quantity was purchased from another milk dealer, who was unknown, and it was from that milk the inspector obtained his quart. Mr. Rook said that the defendant had already been convicted seven times, and had paid an aggregate of £110 in fines. In February, 1875, the defendant was fined £15 and costs for selling adulterated milk; in July, 1876, £20 and costs by the county magistrates; in November, 1877, Margaret Melling, defendant's daughter, refused to supply milk to an Inspector, and a fine of £10 and costs was imposed; in September, 1878, Eliza Melling, defendant's wife, declined to serve an Inspector, and the Bench inflicted a penalty of £10 and costs; in December, 1879, defendant was fined £10 and costs for selling adulterated milk, and during the present month his wife refused to supply milk, and a fine of £5 and costs was imposed. The Bench remarked that it seemed to pay the defendant better to incur heavy fines than to sell pure milk. He would be fined £20 and costs.

At the Northern Divisional Police Court, Dublin, Maria M'Gowan, dairykeeper, of 1, Vavasour Place, was summoned for selling milk adulterated with 13 per cent. of water. The Magistrate remarked that on a former occasion, when a question was raised about milk adulterated to the extent of 13 per cent., which was certified by Professor Tichborne to be pure after it was condemned by Dr. Cameron, the sample was sent over to Somerset House, and a certificate came back agreeing with Professor Tichborne's analysis, that the milk was pure. After that, he did not known what course to adopt in future, but he supposed he would have to make that allowance in the analysis. However, in the present instance, he would allow the case to stand for the return of Dr. Cameron, who was at present on leave.

Refusal to Serve Inspector by Milkman Delivering Milk at Houses. Summons Dismissed:—

In the Southern Divisional Police Court, Dublin, before Mr. O'Donel, a number of summons come on for hearing, in which several milk vendors in the Pembroke Township were charged with having refused to sell samples of milk to the Sanitary Inspector of the Commissioners. In the case of Patrick M'Donnell, the inspector deposed that on the 19th inst. he saw the defendant selling milk at various houses, but when he demanded a sample of milk, and tendered a penny for it, the defendant refused to sell. Mr. Curran, for the defence, contended that the law requires that the exposure for sale should be in a public place, in order that the refusal to sell might become an offence. There was no exposure for sale in a public place in this instance, and the fact of the demand of the inspector having been made on the road would not bring the case within the section. Mr. Fitzgerald, for the Commissioners, contended that the facts of the case were sufficient to warrant the Court holding that the sale was in a public place. His Worship held that the summons could not be sustained. It appeared that if the milk had been sold to purchasers in pursuance of a contract, the inspector would be entitled to demand the sample, whether the delivery was made in a public place or not. No evidence was tendered that in any of the cases immediately before the Court any such contract existed. Mr. Fitzgerald asked to have a case stated for the superior Court. The Magistrate suggested that, before doing that, he should in future bring the householders into Court to see if a contract existed.

Percentage of Adulteration should be Stated:—

At the Wolverhampton Police Court last month, before Mr. W. F. F. Boughey, stipendiary, Mr. Charles A. Hickman, grocer, Sedgley, was summoned by Mr. J. G. Horder, Inspector under the Sale of Food and Drugs Act, for selling coffee not of the nature and substance demanded by the purchaser. An assistant to Mr. Horder went to defendant's shop, on July 23rd, for a quarter of a pound of coffee, which was served in a canister supplied by Cassell, Smith & Co., on which were the words "Mixture of Chicory and Coffee." A certificate from Mr. Jones, the County Analyst, was put in, stating that the article "was practically all chicory." Mr. Willcock, for the defendant, said that the Act of Parliament required that the percentage of adulteration should be stated, and that there was no case. The Stipendiary concurred, and the case was dismissed.

Sale of Paregoric containing no Opium:—

At the Town Hall, Sheffield, before T. W. Rodgers, Esq., and David Ward, Esq., Mr. Stephen Middleton, grocer, 51, Harvest Lane, was summoned under Section 6 of the Sale of Food and Drugs Act, for selling 4 oz. of paregoric, which was not of the nature and substance demanded by the purchaser, being destitute of opium. The Town Clerk (Mr. Yeomans) prosecuted, and Mr. Parker Rhodes, of Rotherham, defended. On June 25th Inspectors Brammer and Rummings, of the Health Department, went to the defendant's shop, and asked for 4 oz. of paregoric. They were not aware that the defendant sold paregoric; but, being in the neighbourhood, went in for the purpose. The defendant took down a bottle from a shelf behind him, and remarked that he was not obliged to sell any of it to them. He was told that if he refused to sell he was liable to a penalty of £10 under the Act, and the defendant thereupon sold 4 oz. of what purported to be paregoric. He previously told the officers to look at the labels upon the bottles, which said "Paregoric substitute, without opium. This article is guaranteed to contain no opium, or any other ingredient prescribed by the new Pharmacy Act, 1868." The defendant, in giving the officers 4 oz. of the contents of the bottle, remarked, "I give it you for what it is worth." The officers then paid 1s., and divided what they received into three portions, one of which was left with the defendant, one was reserved for themselves, and the remaining portion was at once forwarded to Mr. A. H. Allen, the Borough Analyst, to be analysed. Mr. Allen said he found as the result of his analysis that the sample was destitute of opium, which was the most important ingredient in the medicine known as paregoric or paregoric elixir. The material being destitute of opium, he was of opinion that it was not paregoric. Cross-examined by Mr. Parker Rhodes, Mr. Allen said in what was popularly known as paregoric, opium was a constituent part. The word "paregoric" signified soothing. Opium was not the only sedative known to medical science. Dr. Hime, Medical Officer of Health, said opium was an essential part in the composition of paregoric. In its popular sense, paregoric was a medicine containing opium, and included other ingredients. Cross-examined by Mr. Parker Rhodes: In Dr. Pereira's *Materia Medica* it was stated that there could be paregoric without the presence of opium, but that was not the common belief. Mr. Parker Rhodes, for the defendant, said he was instructed to appear, not by the defendant, but by the firm who manufactured the compound. The reason it contained no opium was this: The law prohibited grocers selling any poisonous ingredient, such as opium, and in order that the paregoric might be sold by them, another and weaker article was substituted by the manufacturers, which did equally well. The defendant was well aware of the purpose for which the officers entered his shop, and until he was threatened with a penalty of £10 he did not wish to sell them that for which they asked. He then told them frankly that he sold it for what it was worth, and showed them the label on the bottle, which said "Paregoric substitute." The officers were determined to get it, whatever it was, and they obtained that for which they asked. Several persons who were in the shop at the time strongly bore out Mr. Parker Rhodes' statement; and the maker of the compound, Mr. William Parkinson, wholesale chemist and druggist, of Burnley, spoke as to the nature of the drug. The Bench retired to consider their decision, and, upon their return into court, Mr. Rodgers said that in their opinion the defendant had done everything to show the officers that the drug they insisted upon having was not paregoric, but only a substitute for paregoric, which did not contain opium. The real question in the case was whether he sold it to them as and for paregoric, intending to deceive, or whether he sold it for what it was. Inspectors Brammer and Rummings had not given their evidence to the satisfaction of the Bench, and on behalf of the defendant there had been an overwhelming amount of testimony that could not be cast aside, that the defendant did not pass the drug off as paregoric, but only for what it claimed to be. Alderman Ward said he cordially agreed with Mr. Rodgers' remarks, and he thought the defendant had conducted his business in a very proper way. The case was then dismissed, and the Town Clerk asked permission to withdraw two similar cases which he had intended to have brought forward. The Bench consented to this course being pursued. Mr. Parker Rhodes asked for costs for his witnesses. The magistrates declined to grant them, as they believed it would have saved much trouble, and in every way been more straightforward, if the defendant had at once told the officers, when they asked for paregoric, "I don't keep the article." He had not done so, and therefore they could not allow costs.

Adulterated Milk :—

Mr. Harding, clerk of the Kensington Vestry, supported the following summonses :—Arthur Ayres, of 34, Dartmoor Street, Notting Hill, was fined £1 and costs for selling milk adulterated with 10 per cent. of added water.—William Gardener, of Dalling Road, Hammersmith, was summoned, but the case was dismissed.

James Johnson, of Chesson Road, Fulham, was summoned for selling milk to Inspector Francis, of the Board of Works, adulterated with 20 per cent. of added water. Mr. Jones, clerk of the Fulham Board of Works, attended to support the summons and other cases. The defendant said he sold the milk in the same condition as he purchased it. Mr. Paget inflicted a penalty of 40s., with 12s. 6d. costs.

Alfred Roughton, a general dealer, of Greyhound Road, Fulham, was next summoned for selling milk adulterated with 40 per cent. of added water. In this case the inspector purchased the milk of the defendant's wife in the shop. The defendant said he purchased milk of Mr. Johnson, the defendant in the first case, giving 1s. 10d. per gallon for it. Therefore he thought he had a superior article, and he sold it as he he purchased it. Mr. Paget said it was the worst case of adulteration he had ever heard, the water in the milk being nearly one-half, and it was sold to be given to children and sick people. He fined the defendant £5 with 12s. 6d. costs. The defendant said he was not able to pay the money. Mr. Paget then made an order for the defendant to be imprisoned for one month in default of sufficient distress.

John Hanson, of Fulham Fields, was summoned in respect of milk adulterated with 16 per cent. of added water. Mr. Claydon, who defended, said the milk was supplied to defendant by a respectable firm, and he sold it in the same state as he received it. He (Mr. Claydon) asked the magistrate to bear in mind that cows did not give milk of the same quality at all times. Mr. Paget said it was so, but in this case the certificate of the analyst stated the milk contained added water. Mr. Claydon said he did not know how the analyst was able to come to that conclusion, but he was not prepared to advise his client to incur the expense of the attendance of the analyst to give his reasons. Mr. Paget fined the defendant 40s., with 12s. 6d. costs.

Mr. Jones, clerk of the Fulham Board of Works, supported summonses against persons for selling adulterated milk. The first case was against Hastings Wigmore, of 37, Moore Park Road, Fulham, for selling milk adulterated with 12 per cent. of added water. Mr. Paget inflicted a penalty of 20s. and 12s. 6d. costs.—The summons against John Harrison, of Salisbury Terrace, Fulham Fields, for selling milk adulterated with 16 per cent. of added water, was adjourned for the production of additional evidence.—George Connell, of the Royal Dairy Farm, Wellesley Road, Gunnersbury, was summoned for selling milk adulterated with 18 per cent. of added water. The defendant said the milk was purchased in the street, and he told the inspector that he could not guarantee it as it came from the country. Mr. Gregg declared that the milk was purchased in the shop. The Chairman explained that it did not matter whether the milk was bought in the shop or in the street. The defendant was liable, and would have to pay £1 and costs.

Refusing to Serve. Cases Dismissed :—

At the Northern Divisional Police Court, Dublin, Michael Condraw, a milk-boy in the employment of Mr. T. M. Donnall, dairyman, Mountpleasant Place, was summoned before Mr. O'Donel for having refused to give a sample of milk for the purpose of analysis to Mr. J. Madden, inspector of nuisances under the Pembroke Township Commissioners. Mr. Madden stated that on Aug. 19th he met the defendant serving milk on the Shelbourne Road, when he asked for a pennyworth, telling the boy who he was, and that it was required for purposes of analysis. The lad said he should wait until he came down from the next house and ran on. When he came down from the house he refused to give the milk; some time after he ran up to witness with the milk-can, and offered to give milk out of a different can, but witness refused to take it. Mr. Curran submitted that this disclosed no offence, as the 17th section of the Act under which the prosecution was brought required that the milk should be sold by retail or exposed for sale. In the present instance the milk was not exposed for sale, as the defendant was merely engaged in delivering milk at houses. The magistrate (Mr. O'Donel) held the point raised a good one, and dismissed the summons, but at the request of Mr. Fitzgerald, said he would state a case for the purpose of having the point argued.—William Doyle, dairyman, of Sandymount, was summoned for a similar offence, and a like rule was made.—Mary Smith, 14, South Lotts Road, dairykeeper, was summoned for refusing to sell milk exposed for sale in her shop to a sanitary inspector, for the purpose of being analysed. Defendant denied that she owned the shop, alleging that she was only left in charge of it by Mrs. Redmond, the owner. As the inspector swore, however, that he had seen her behind the counter on three different occasions previously, she was fined £2.

Adulterated Milk.—Samples taken at Railway Station.:—

At Southwark, Mr. J. M. Sawyer, a farmer, residing at Chadhurst Farm, Dorking, appeared in answer to a summons issued against him by Mr. C. Puttock, a dairyman, living in Sayers Street, New Kent Road, for a breach of agreement in not supplying him with pure and fresh milk as contracted for from March 25th, 1880, to March 25th, 1881. Mr. W. P. Ricketts, solicitor, appeared for the prosecution. Mr. A. Parish, inspector for the Metropolitan Dairy Society, was also in attendance. It appeared from the evidence of Mr. C. Puttock, the plaintiff, that having received numerous complaints from his customers of the indifferent quality of the milk dispensed by him he felt rather annoyed, and having procured the services of Inspector Parish they went to London Bridge Station, to which the cans or churns full of milk were sent. On the 27th of June last, having had the cans sealed by the inspector, a telegram was sent to Mr. Sawyer to meet them at London Bridge Station on the following day, the 28th June, when the milk cans would be opened and three divisions would be made, one of which Sawyer could have, one would be kept by the dairy inspector, and the third would be sent to the Public Analyst. This had been done, and the latter had certified that it was adulterated with water to the extent of 18 per cent. The contract between complainant and defendant was then read by Mr. Ricketts, which ran substantially as follows:—"Chadhurst Farm, Dorking, April 6th, 1880. A contract entered into between Mr. C. Puttock, 4, Sayers Street, New Kent Road, and Mr. J. M. Sawyer; the latter to sell all the milk produced by his cows from March 25th, 1880, to March 26th, 1881, the milk to be delivered, carriage paid, to London Bridge, pure and fresh daily." Some other ordinary clauses followed. The Magistrate said in his opinion the case should not have been brought before him; it was a county court case, and he considered that the defendant's contract begun and ended, as regarded the purity of the milk, at Dorking. Mr. Ricketts disagreed with his Worship. The contract to deliver the milk pure and fresh in London was very distinct indeed. His Worship said there was a very similar milk case pending just now, and perhaps an adjournment might be advisable. Mr. Ricketts said: Very well. I suppose your Worship will grant a case, and let this be adjourned *sine die* till a decision is arrived at in the other. Mr. Puttock said all he wished to prove to his customers was that he endeavoured to sell pure milk from the cow, and the *laches* on the part of the defendant in not sending him milk as contracted for and guaranteed by him to the public as unadulterated had done him a serious trade injury.

Prosecution by Metropolitan Dairymen's Association. £20 Fine. Appeal:—

Isaac Peart, a farmer, of Irvingbury Farm, Welwyn, Hertfordshire, appeared to a summons which charged him with having sold a quantity of milk adulterated with water. Mr. Moore, for Mr. Ricketts, conducted the prosecution, and Mr. Besley, barrister, defended. The evidence went to show that the defendant had an agreement with Thomas Edwards, dairyman, of Fonthill Road, Finsbury Park, to supply him with 18 or 20 barn gallons of pure milk daily. This arrived in two consignments in the defendant's churns at Finsbury Park Station of the Great Northern Railway. In consequence of complaints, Mr. Edwards on the 6th of July awaited the arrival of the morning delivery, and then in the presence of the station-master and a witness named Parish, sealed up one of the churns and sent a telegram to the defendant, requesting his attendance at an examination of the contents for analysis. The defendant sent his son, in whose presence the churn was opened and samples of the milk taken. The certificate of Dr. Tidy, to whom the same was submitted for analysis, showed that the milk was adulterated to the extent of 19 per cent. Mr. Besley, in cross-examination of the witnesses, elicited that the prosecution was taken up and the expenses paid by the "Metropolitan Dairymen's Association." Parish was "an inspector" appointed to act for them. Parish was subjected to a long cross-examination, and admitted that he had gone a fortnight after the examination of the milk to the defendant's farm and been treated there by him, but denied that there was any suggestion that a £5 note to him and a subscription to the Association would prevent a prosecution. Mr. Besley, in his address for the defence, said that he had to raise a legal point which he thought was of vital importance in these prosecutions. It had been held to be necessary that there should be a purchase before there could be a prosecution. In this case there was no purchase, no agreement beyond a verbal understanding being proved. Before purchase it was also necessary that there should be a request embracing the nature, quality, and substance of the article required. In support of this Mr. Besley quoted Sandys *v.* Small, 3 Q. B., and Hutchinson's case, 4 Q. B. Reports. Dismissing the point which the Courts of Session in Scotland had held to be law, that a person purchasing for analysis could not be said to be prejudiced, a point overruled by the High Court here, Mr. Besley submitted that the other points were clear. Further he submitted that by the amending Act of 1879 only a medical officer, constable, or other public officer could prosecute in these cases. Mr. Besley read the third section of the Act to that effect. The Act, he said, did not exist to allow the Association mentioned to find a *raison d'être*. The Association was admitted to be the prosecutors in this case, and they could not be. Moreover, they had tried by their witness Parish to force the defendant to join the Association and give his subscription under fear of prosecution. The defendant was examined, and his son, and other witnesses were called to prove that the milk was not adulterated at the farm, and railway servants, to prove that it was not tampered with on the journey. The defendant gave a description of the visit of witness Parish, and ended by saying that the Association had since made him an hon. member. The magistrate, Mr. Barstow, decided against Mr. Besley, on all his legal points, and finding the case proved, ordered the defendant to pay a penalty of £25, £5 of the amount to be costs. Notice of appeal was given.

Overstocking a Cow:—

At the Northern Divisional Police Court, Dublin, Patrick Kean, of Newton, County Dublin, was charged with having "over-stocked a cow with milk, thereby causing it pain and suffering." Mr. Keely, a veterinary surgeon, deposed to having examined the cow, when he found that two of the teats had been plugged up artificially, so that milk could not flow through them. The greatest pain was caused to the animal in consequence of this. The Magistrate observed that this was a new method of procedure. The object was to keep the udder of the cow distended, so that it would fetch a higher price in the market, but the animal would be permanently injured. The defendant denied that he had used any instrument or adopted any means to plug the teats. He wished to have the case adjourned to afford him an opportunity of employing another veterinary surgeon to inspect the animal. The cow was in the police courtyard, and the Magistrate suggested that it should be milked in the presence of Mr. Keely to settle the question. The operation was accordingly performed in the presence of a large number of those who had been attending at the Court. Mr. Keely was examined, and deposed that milk had flowed through the teats, but only in the exercise of great pressure. He still remained of opinion that the animal had been tampered with in the way he had previously described. The defendant made repeated requests to give him an opportunity of procuring a veterinary surgeon, but the Magistrate considered that he had had sufficient time to procure a surgeon during the afternoon, and fined him 30s.

Coffee and Chicory:—

Several grocers were summoned before the magistrates at Barnsley, recently, for selling adulterated coffee. The first case heard was that of Mr. Matthew Dickinson, grocer, of Birdwell, who was charged under the Food and Drugs Act with selling coffee which was not of the nature and substance it ought to be. Superintendent Sykes visited defendant's shop at Birdwell on the 21st inst., when he purchased four ounces of coffee, for which he paid 5d., at the same time telling defendant that it would be sent to the analyst. He left defendant a portion of it, and sent a third of that purchased to Mr. Allen, the Borough Analyst, at Sheffield, keeping the remaining portion himself. The analyst reported that the sample contained 40 per cent. of chicory, a mixture of which with coffee was objectionable. Defendant said he sold the coffee as he purchased it. The Bench said they hoped it would be a warning to other shopkeepers, who were getting immense profits by selling adulterated articles. Defendant was fined £2 and costs, in all £2 15s. 11d. Mr. William Heaton, also a grocer, of Birdwell, was charged with a similar offence. The same day Superintendent Sykes purchased four ounces of coffee for 3d. at defendant's shop, telling him for what purpose he required it. The analyst reported that the sample contained 50 per cent. of chicory. Defendant said he did not sell the coffee as being genuine, but as common, by which he meant that it was mixed. The Bench said genuine coffee could not be bought for the price, and fined defendant £2 and costs.

NOTES OF THE MONTH.

A quarterly meeting of the Birmingham and Midland Counties Grocers' Protection and Benevolent Association, reported in the *Grocer*, is characterized by a speech from the chairman protesting against the prosecution of persons for selling coffee mixed with chicory. In his remarks he brings up the case of a man who was actually fined for selling a mixture of 85 per cent. chicory and 15 per cent. coffee, and argues that because chicory is 8d., and coffee 1s. 8d. per pound, there was no fraud in selling this at 10d., especially as, in his opinion, good chicory is a better beverage than inferior coffee. We quite agree that it is *no fraud to sell* any mixture provided it is properly labelled as such, and the purchaser honestly informed before buying what he is getting; but then, some grocers would like to be able to mix, and yet not declare so.

The next proposition—made by the same gentleman—was, that the Association should pay the fine of a member who had been mulct in £10 for selling butterine. This, he considered, a "most shameful fine," and urged that butterine was a good and wholesome article. So it may be; but was it sold in reply to a request for butter? We should like to hear this gentleman's opinion of a tailor who sold him cheap cloth trousers all wool, and then gave him a shoddy article which was innocent of coming direct from the sheep, although still wool being worked up from other materials as an imitation. Would he declare that such a wretch ought to be prosecuted, or would he sit down quietly and say, "It was my own fault. I should have known the market price of spun wool, and that I could not get real cloth at the money?" The public cannot be expected to know the real value of everything, and the only way to protect them is to see that traders, who pretend to sell a particular article at a low price to attract custom, shall honestly sell the commodity they seem to do.

In making these remarks, we must not be held to insinuate that grocers, as a body, really desire to fall in with the views of such gentlemen; because, at the very same meeting we find three British tradesmen, to their honour and credit, speaking out in the cause of absolutely fair dealing as follows:—

Mr. Batt *thought that butterine should be sold for what it really was—butterine, and not butter.*

Mr. Cole *thought it unfortunate that grocers should bolster up a 10d. article, which many were doing at the present time.*

Mr. Jephcott *did not like to see an article passed off as a luxury which contained 90 per cent. of chicory. They had better sell the article as chicory flavoured with coffee.*

Bravo Messrs. Batt, Cole, and Jephcott! We hail your remarks as specimens of real blunt truth, and if we lived in your county we should say these are the sort of men to deal with. We hope that the Birmingham public and newspapers will notice such open dealing, and that the reward which ought to follow will come apace.

Under the new Beer Duty Act the strengths of worts are to be expressed in terms of their specific gravities, and not in "lbs. per barrel." The *Brewers' Guardian* points out that no change need be made in the instruments used provided the "lbs. per barrel" indicated is multiplied by 2·777 and 1,000 added, which will give specific gravity. So far as analysts are concerned, the doing away of an antiquated standard, and the substituting of a definite one actually capable of absolute verification by the balance is certainly a step in the right direction, and one reflecting credit on the chemical authorities of the Inland Revenue.

Correspondence.—We have received another letter from Mr. Edge on the subject of Milk Analysis, but we have no space to print it.—Eds.

Adulteration of Drugs.—At a recent meeting of the Board of Guardians of Gorey Union, a resolution was adopted that, in future, all medicines supplied to the Union should be analysed by Dr. Cameron of Dublin. A similar resolution has been passed by the Newcastle Guardians, who have determined to have the contractor prosecuted if the drugs, on analysis, are found to be adulterated.

Our Smyrna correspondent informs us that the Chio islanders ask exorbitant prices for their turpentine this year, they having discovered that a special medical demand has sprung up.

SOCIETY OF PUBLIC ANALYSTS.

The following gentlemen have been elected Members of this Society:—Dr. S. A. GOLDSCHMIDT, F.C.S., of New York; Dr. J. BLAKE WHITE, of New York.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1880 No.	Name of Patentee.	Title of Patent.	Price.
250	J. W. Swan	Electric Lamps	6d.
268	A. M. Clark	Obtaining Glucose and Alcohol	8d.
315	W. R. Lake	Apparatus for Generating and Utilizing Electricity	1/0
338	G. W. Von Naurocki	Treatment of Woven Fabrics	4d.
350	J. P. C. De Puydt & J. Cougnet	Electric Lamps	2d.
366	A. L. Bruce, G. Stenhouse, W. McCowan, and A. Haddon	Machinery for Treating Dextrine, &c.	8d.
385	T. F. Scott	Manufacture and Preparation of Starch	4d.
397	G. A. Harvey	Removing and Destroying Sewer Gases	2d.
441	C. Kisseler	Obtaining Ammonia in the Carbonisation of Bones	6d.
445	E. Posselt and R. Peters	Dyeing Cotton Aniline Black	6d.
317	H. White	Apparatus for Straining Paper Pulp	6d.
455	T. H. Blamires	Lamps for Electric Lighting	6d.
460	P. Corcoran	Liquid for Scouring, &c.	2d.
478	T. Morgan	Electro and Dynamo Electric Machines	4d.
479	T. J. Smith	Apparatus for Extracting Juices from Beetroot, Sugar Cane, &c.	2d.
512	McGaan	Spirits	4d.
516	A. Vanderghote	Apparatus for Saccharification	2d.
521	D. Hulett	Apparatus for Purifying Gas	8d.
529	W. R. Lake	Red Colouring Matter	4d.
536	J. A. Dixon	Colouring Matters	4d.
608	Carey, Gaskell and Hurter	Purification of Alkaline Solutions	4d.
938	F. C. Glaser	Bleaching Straw	4d.
572	H. J. Allison	Apparatus for Treating Beetroot	4d.
578	T. A. Edison	Electric Lamps	8d.
599	W. R. Lake	Anæsthetics	4d.
602	T. A. Edison	Utilization of Electricity	8d.
619	J. F. G. Kromscroder	Coal Gas	6d.
620	R. Cromlet	Purifying Oils	6d.
621	W. R. Lake	Refrigerating Apparatus	6d.
622	H. Bright	Softening Water	2d.
627	H. Palin	Extracting Pigments	4d.
630	R. T. D. Broguham	Electric Lighting	2d.
636	A. M. Clark	Electric Light	6d.
655	Collingridge & Lecerf	Brewing	4d.
837	E. Solvay	Hydrochloric Acid	4d.
838	E. Solvay	Hydrochloric Acid and Chlorine	6d.
839	E. Solvay	Chloride of Lime	2d.
840	E. Solvay	Cement	2d.
923	W. E. Gedge	Animal and Vegetable Extracts	4d.
553	G. W. Wigner	Electric Lamps	8d.
623	H. Elmore	Brewing	4d.
708	A. M. Clark	Cereals	8d.
730	W. R. Lake	White Lead	6d.
738	J. C. Blomfield	White Cement	2d.
742	J. W. Tongue	Cleansing Sugar Polluted Water	6d.
748	J. Duke	Manures	6d.
778	W. K. Lake	Yeast	4d.
789	C. Harrison	Inflammable Gas	2d.
796	J. W. Zambra	Thermometers	2d.
815	W. Morgan Brown	Moulding Sugar	6d.
1902	J. H. Radcliffe	Fire Extinguisher	6d.

BOOKS, &c., RECEIVED.

Alum—Its Effects when introduced into Pastry, by J. West Knights, F.C.S.; The Chemist and Druggist; The Brewers'Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; *The Chemists' Journal*; Alcohol Tables, by Stevenson.

THE ANALYST.

NOVEMBER, 1880.

SOCIETY OF PUBLIC ANALYSTS.

The Next Meeting of this Society will be held at Burlington House, Piccadilly, on Wednesday, the 17th inst., at Eight o'clock.

ON THE ESTIMATION OF PHOSPHORIC ACID IN POTABLE WATER.

By J. West-Knights, F.C.S.

The gravimetric method for the estimation of P_2O_5 in potable waters, proposed by Otto Hehner, F.C.S. (The Analyst, vol. iv., p. 23, and vol. v., p. 135), is undoubtedly an excellent one, and, with ordinary care and precautions, furnishes very accurate results. But still, I doubt whether water analysts, as a body, will avail themselves of the advantages to be derived from a knowledge of the proportions of P_2O_5 in a sample of water, obtained by that method, in forming an opinion as to its fitness for drinking purposes, for the simple reason that the process requires more time and attention than can be given without extra charge for the analysis, and, as many of us who hold public appointments are bound to report upon water for a fixed fee, it is obvious that if we attempt the determination at all, it must be by a more simple method.

The great accuracy with which minute quantities of substances in solution can be measured by depth of tint produced by re-agents, which, in more concentrated solutions, would have produced precipitates; or, in other words, the high tinctorial power of coloured substances that are very sparingly soluble is well known, and upon this fact the present method is based.

If to a very dilute solution of a phosphate, molybdate of ammonia is added, and the mixture boiled, no precipitate is produced, but a bright yellow colour which varies in intensity, in proportion to the quantity of P_2O_5 present.

To apply this to the estimation of phosphoric acid present in potable water, certain precautions are necessary. As silica gives a very intense yellow colour with the molybdate, it is obvious that that substance must be separated before titration, and as the quantity of nitric acid present has a great influence upon the intensity of colour produced, care must be taken always to have the same quantity in making the comparison.

The process is conducted as follows: ·50,425 grm. of crystallized non-effloresced sodic phosphate are dissolved in 1 litre of water; or, what is better, 50 c.c. of the standard solution of sodic phosphate that is used for the titration of uranic solution (*Sutton's Volumetric Analysis, 3rd edition, p. 220*), are diluted to1 litre. Each c.c. of this solution equals ·0001 gramme of P_2O_5. A neutral solution of molybdate of ammonia is made by dissolving about 75 grammes of that salt in 1 litre of water.

70 c.c. of the sample of water are evaporated to dryness with HNO_3 and gently ignited to separate SiO_2, the residue is then taken up with 1 c.c. of dilute HNO_3 (1 : 5) and boiling

water, filtered, and the filtrate made up to 70 c.c. (the original volume). This is placed in a small beaker—capable of holding about 100 c.c., and put over the gas; as soon as ebullition has commenced, 1 c.c. of the molybdate solution is added, and the beaker placed on a sheet of white paper, the yellow colour observed, and imitated by using 70 c.c. of distilled water, 1 c.c. of the nitric acid, sufficient quantity of the phosphate solution, and 1 c.c. of the molybdate. The number of c.c. of the phosphate solution used divided by ten equals grains of P_2O_5 per gallon. The process very much resembles nesslerizing, with the exception that the comparison must be made whilst the liquids are quite hot, as the colour fades considerably on cooling.

The degree of accuracy obtained by this method, would, of course, vary with the capability of the operator for observing slight difference in the depth of tints, but I do not think anyone would fail to observe a difference of ·00005 grammes. When small quantities only are present, it is, of course, open to the analyst to concentrate the water to any convenient extent, in which case the accuracy of the estimation would be increased in like proportion. It will be readily acceded that such degree of accuracy is amply sufficient from a practical point of view; as I am sure no-one's opinion upon a water would be modified by a difference of ·00005 grammes of P_2O_5 in each estimation, when the total quantity present equals ten times that amount, as it always will, even in waters containing a very slight quantity, if a suitable degree of concentration has been obtained. The filter paper used must be washed with dilute nitric acid and boiling water before use, or a considerable error will be introduced.

I have worked this process repeatedly, side by side with the gravimetric method of Hehner, with very satisfactory coincidence.

The following is a short table of results obtained by this method, most of which have been verified by the gravimetric method :—

GRAINS PER GALLON.

WATER.	Total Solids.	Chlorine.	N as Nitrates, &c.	Free Amm.	Alb. Amm.	P_2O_5.
Shallow-well water, Ely	109·9	6·80	1·09	·0028	·0350	·70
,, ,, ,,	104·3	4·90	1·38	·0056	·0126	·75
,, ,, Swavesey	133·7	15·40	2·88	·0056	·0210	1·20
River water, Cam	—	—	—	—	—	·35
,, ,, Ouse	—	—	—	—	—	·40
Cambridge Supply	26·0	1.40	·33	·0140	·0014	·40
Shallow-well water	73·0	4·4	1·15	·0210	·0210	·70

From the above table it will be seen that I have found far greater quantities of P_2O_5 than Mr. Hehner did, but this will no doubt be accounted for in the fact that my samples consisted chiefly of highly polluted shallow-well waters from the greensand, whilst his were (probably from deep wells) from the chalk formation, with the exception of those obtained from the Thames.

I shall not attempt to draw any lines between the quantities of P_2O_5 present in "good," "suspicious," and "plainly polluted" waters, for until further results have been obtained it would be impossible to do so; in the meantime, the estimation will certainly be of some value to those who take every item of a water analysis into consideration.

I have also applied this method to the estimation of P_2O_5 in wine, beer, and milk, *with good* results.

PHOSPHORIC ACID IN POTABLE WATERS.

By Sidney Harvey, Canterbury.

Having for a long time past found it necessary to take into account (at least qualitatively) the presence of phosphoric acid in samples of water daily submitted to me, I read with pleasure Mr. Hehner's paper upon the subject in the Analyst for August, and can fully endorse his statements therein.

Since the publication of the above paper I have made a fuller examination of the "total solid residue" resulting from every analysis, specially for the purpose of testing for and estimating the P_2O_5 almost invariably present, and it appears to me that the time has arrived when the amount of phosphoric acid in water should be included in a report, and should be accepted as another "clue" (and we have none too many) to aid us in our judgment of the purity, or otherwise, of a sample. Thanks to Mr. Hehner, his paper of January, 1879, embodying, as it does, an exact and easily worked process will greatly lighten the additional labour involved. The following are the analytical data of a water reported upon by me on October 25th, taken from an old and shallow well close to an ancient churchyard in this city, and which has been closed for many years.

The water was very clear, free from smell, deposited very little upon standing, and gave copious precipitates with oxalate of ammonia and chloride of barium, and contained, as usual in this chalk district, much carbonate of lime :—

	Grains per gallon.	Parts per million.
Combined Chlorine	10·01	143·
Total Solid Residue	95.9	1370
Nitrogen as Nitrates and Nitrites	5·023	71·7
Phosphoric Anhydride (P_2O_5)	1·03	14·71
Free Ammonia	—	0·01
Albuminoid Ammonia	—	0·09

Not only did the residue of 70 c.c. of this water, when suitably treated, give a considerable precipitate with molybdic solution; but a little of the water *itself*, when warmed, gave a very distinct yellow colour upon adding the above re-agent.

In conclusion, I may remark that I operated upon a sufficient quantity of water to ensure accuracy in my results, which I commend to the attention of those who may still doubt the possibility of the presence of phosphoric acid in water in anything more than a mere trace.

NOTE ON AN OLD TIN OF PRESERVED MEAT.

By G. W. Wigner, F.C.S., &c.

During the recent International Food Exhibition, Mr. Leonard Wallington brought under the notice of the judges a remarkable tin of preserved meat. This tin had been in Mr. Wallington's possession for twenty-nine years, and was, he supposed, some five or six years old when he received it. It was tinned (as appeared by the stamp on the tin) by D. Hogarth & Co. The tin was of what we should consider now to be unusual thickness. It had apparently been painted outside with an oxide paint; but, notwithstanding this, the exterior of the tin had corroded so much that in dusting it carefully two small scales were displaced, which left pin holes in the metal.

It was not convenient to open the tin for five or six days after this, and the contents began to smell. No odour had been perceptible in the first instance. When the tin was cut open, and the contents emptied in the form of a solid lump, two patches of decomposed meat were seen, each about 1½ inch by ¾ inch, spreading from the two pin holes. The rest of the meat was sound, and, after the removal of the decomposed patches, appeared to be in excellent condition. It was tainted, but it was clear that was due to the odour from the decomposed patches, for, when washed, all taint was removed.

The contents consisted of veal, with a large proportion of fat, and a few peas. The fat appeared to be entirely the natural fat of the meat.

The meat was analysed, and gave only ·68 per cent. of ash. This ash was free from lead, but contained minute traces of tin. The quantity was far too small to estimate quantitatively. It was unquestionably less than the proportion usually present in tinned goods one year old. The salt was also low, and this may have something to do with the absence of tin. Only ·09 per cent. was found. This looks as if the veal had been boiled, and the liquor decanted before canning.

The most important result was that lead was absent. There has not been time enough to assay the metal of the can; but it seems pretty well evident that it was really tinned iron plate, and not Terne plate, containing lead.

Thirty odd years is a long test for tinned meat; and it is remarkable that any portion of it should have been quite free from decomposition after that time. Such a successful result may possibly lead to the use of better and sounder tins than those now in vogue.

ABSTRACT OF A PAPER READ BEFORE THE CHEMICAL SECTION OF THE BRITISH ASSOCIATION.

On the Specific Rotatory Power of Cane and Invert Sugar.

By Alfred H. Allen, F.C.S.

The angular rotation produced by a plate of 1 mm. in thickness is 24 degrees for the mean yellow ray or transition tint. In Soleil's polarizing saccharimeter the 24 angular degrees are graduated into 100 divisions, and in using the instrument a solution of cane sugar is employed of such concentration that a column of two decimetres in length shall cause a deviation of 24 degrees, or 100 divisions.

If S be the apparent specific rotatory power of an optically active substance in solution; A, the angular rotation observed; L, the thickness in decimetres of the solution traversed by the ray of polarized light; and C the number of grammes of solid in each 100 c.c. of solution; the value of S can be found by the following equation:—

$$S = \frac{A}{\dfrac{L \times C}{100}}$$

It is agreed by numerous observers that the apparent specific rotatory power of cane sugar in aqueous solutions containing at least 10 per cent. of the solid is + 73·8° for the transition tint.

Substituting this value for S in the above equation; 24° for A; and 2 for L; we obtain—

$$73.8 = \frac{24}{2 \quad \frac{C}{100}} \text{; whence } C = 16{\cdot}26$$

Hence the proper weight of sugar to be taken for use with Soleil's saccharimeter is 16·26 grammes, and not 16·19, 16·35 grammes, or any different weight. It it be contended that either of these alternative quantities is the right one to employ, it follows that + 73·8° is not correct for apparent specific rotatory power of cane sugar.

According to Tuschmidt, Casamajor, and many other observers, a solution of cane sugar which, before inversion, shows a deviation of + 100 Soleil divisions gives, after inversion, a negative rotation of — 44 divisions at 0° C, decreasing by one division for each rise of 2° C, so that the inverted solution will show a deviation of — 37 at 14° C, and — 36·5 at 15° C.

Many writers on the rotatory power of invert sugar have overlooked the fact that inversion causes an increase in the weight of solid matter in the solution, 95 parts of cane sugar yielding 100 parts of inverted sugar. This increase of weight ought to be taken into account in calculating the specific rotatory power of invert sugar, which at 15° C is really 25·6°.

$$\mathrm{Sj} = \frac{-\,36{\cdot}5 + {\cdot}24}{2 \times \frac{=\,16{\cdot}26}{95}} = -\,25{\cdot}6$$

This number corresponds to a value of — 25·94° for Sj at 14° C, instead of —25·0, as generally stated. If 16·19 grammes be adhered to as the normal weight of sugar per 100 c.c., the value of Sj at 14° C becomes — 26·05°, against — 25·0° as usually taken.

If the value of Sj for invert sugar be taken at — 26° (the mean of the above values) and O'Sullivan's figure + 57·6 be adopted as the value of Sj for dextrose, then the specific rotatory power of lævulose at 14° C is — 109·6°, instead of — 106°, as usually taken.

$$(26 \times 2 + 57{\cdot}6 = 109{\cdot}6.)$$

To sum up, the corrected values of Sj are as follows :—

	Sj.
Cane Sugar	+ 73·8
Invert Sugar	— 25·6 at 15°
Dextrose	+ 57.6
Lævulose	— 108·8 at 15°

The deviation, according to the average results of various observers, produced by a plate 1 m.m. in thickness, is 24° for the mean yellow or transition tint, and 26·66° for the sodium ray. Hence the above values for Sj may be calculated to the corresponding values or S_D by multiplying them by the factor—

$$\frac{21{\cdot}66.}{24} = {\cdot}9025$$

ABSTRACT OF PAPERS READ BEFORE THE BRITISH PHARMACEUTICAL CONFERENCE AT SWANSEA.

NOTE ON INDIAN HENBANE.

By T. Greenish.

THE official biennial henbane leaf has of late years become very scarce in this country, and it was with considerable interest that the author undertook the examination of a small sample of henbane leaf sent from India by Dr. Dymock. It arrived in a tin box without any particulars as to its being the produce of the annual or biennial plant, place of growth, character of soil, the result of cultivation, or otherwise. On removal from the tin the leaves had a clammy feel; they possessed an intense odour, very persistent on the hand, and generally stronger than that of ordinary henbane.

Dried at 80° F., it lost 7 per cent. The odour passed off almost entirely in the process of drying.

A tincture prepared by maceration was a brown-olive, whereas the official tincture is olive-green, and the colour more intense. A little added to water produced no opalescence, and gave only a tinge of colour; the official tincture, on the contrary, produced considerable opacity, which, on the addition of a little liquor potassæ, disappeared.

In the general structure of the leaf the author found no very material difference.

Extracts made from the two tinctures were relatively 3·43 for the Indian henbane, as compared with 4·20 for the British Pharmacopœia.

It might be worth while to make a tincture with the leaf without previously drying it, so that the strong odour which is probably due to some volatile principle, and also the acridity might be retained, and probably increase the therapeutic value of the product.

ON THE DETECTION OF AMORPHOUS QUININE IN CITRATE OF IRON AND QUININE.

By Dr. De Vrij.

AMORPHOUS QUININE substituted for crystalline in the above is easily soluble in ether, and the substitution will not, therefore, be detected by the test of the Pharmacopœia. It can, however, be detected by transforming the separated quinine into a neutral oxalate. This oxalate after being thoroughly dried on a water-bath is dissolved in chloroform, and the solution, if necessary, filtered. If a few drops of water are put on the top of this solution in a test-tube the oxalate of quinine will take a part of the water and crystals of oxalate of quinine will appear in the chloroform, whilst the water on the top remains clear and uncoloured if the medicine is not sophisticated. If it contains, however, amorphous quinine the oxalate of this base will be taken up from the solution in chloroform, and the water on the top of this solution will be more or less yellow coloured by the oxalate of amorphous quinine which has been dissolved by the water.

THE PRESENCE OF ARSENIC IN TINCTURE AND SOLUTION OF PERCHLORIDE OF IRON.

By F. W. Fletcher, F.C.S.

THE author enumerated several observations of the presence of arsenic as an impurity in pharmaceutical preparations, and to that list he said he had the melancholy satisfaction of contributing an addition. Having detected arsenic in samples of hydrochloric acid, many of which had been sold as pure, he thought that possibly a considerable portion of the liquor ferri perchlor. of pharmacy prepared with similar acid might contain arsenic. This had proved to be the case in samples of the liquor, and also of the tincture, which had been obtained from various eminent dispensing houses. In one instance the proportion of 33·8 grains As_2O_3 in the 100 fluid oz. of the liquor were detected. The other instances given showed 10, 12, and 13 grains per 100 fluid oz. of liquor.

THE GRAVIMETRIC ESTIMATION OF MINUTE QUANTITIES OF ARSENICUM.

By F. W. Fletcher, F.C.S.

AFTER pointing out that the various processes in use for the estimation of arsenic, including those of Levol, Rose, and Herapath, are inapplicable to the determination of minute traces of this substance, the author described a method he had devised for the purpose, founded upon a reaction first observed by Soubeiran, viz., that when a stream of arseniuretted hydrogen is passed through a solution of nitrate of silver, a precipitate of metallic silver is obtained in accordance with the equation:—

$$\underbrace{6AgNo_3}_{1020} + 3\,H_2O + \underbrace{AsH_3}_{78} = 6HNO_3 + H_3AsO_3 + \underbrace{3Ag_2}_{648}$$

From which it is seen that for every 75 parts of arsenicum obtained in the state of AsH_3, no less than 648 parts of silver are thrown out of solution. "In other words, when the amount of arsenicum to be estimated does not amount to more than $\frac{1}{3}$ milligramme (or about $\frac{3}{1000}$ grain) the weight of the silver precipitate is so large as to be capable of accurate determination on any balance of average delicacy."

The author's apparatus consists of a hydrogen flask connected with a series of bottles containing decinormal solutions of lead acetate and silver nitrate. When the arsenical solution is added to the hydrogen flask arseniuretted hydrogen is passed into the solution in place of pure hydrogen. This decomposes the silver solution, and by weighing the precipitate of silver the proportion of arsenicum is estimated. One part of silver corresponds to ·1157 of arsenicum, or to ·1527 of arsenious acid. By testing in this way with known quantities of As_2O_3 such results as the following were obtained:—·00292 gramme gave ·00235 to ·00241 gramme, ·00584 gramme gave ·00525 and ·00519 gramme, ·01168 gramme gave ·01075.

The other substances which might form gaseous compounds with hydrogen were antimony, sulphur, tellurium, selenium, and phosphorus. Antimony should be especially sought for, phosphorus might be converted into phosphate, the rest would be arrested by the lead.

The author also described experiments by this method, whereby traces of arsenic had been estimated in subnitrate of bismuth, sheep's stomachs, &c.

INTERNATIONAL FOOD EXHIBITION.

The following are extracts from the Award of the Judges at this Exhibition, which was held at the Agricultural Hall, from the 13th to 20th October:—

The Exhibition is a remarkably representative one. As nearly as we can tell, there are close upon 8,000 different and specific varieties of food and food products, prepared in various forms, and cooking utensils on exhibition. It would, of course, have been absolutely impossible, in the limit of a week, to test every one of these, but we have adopted the plan of selecting from those which were considered by each exhibitor, acting on behalf of the manufacturers, the best, and in very many cases also the worst of each class.

We have been much pleased by the almost entire absence of adulteration, properly so called; out of some thousands of samples examined, there have been less than five instances in which the article has not been fairly and honestly described by the name or label. This result is so far satisfactory, in that it shows that there is no commercial difficulty in the way of pure goods, which will meet all the requirements of the Sale of Food and Drugs Act, being turned out in sufficient quantities for sale.

There are a large number of samples of tinned fish exhibited, but a good many of these are of inferior quality, due, partly to the character of the tin in which they have been packed, and partly to overcooking. In one or two cases, however, these difficulties have been almost, if not entirely, overcome, especially in the case of salmon. The efforts of canners should be directed towards the proper enamelling of the tins and canning at a lower temperature.

The tinned meats were, as a rule, carefully prepared, and most of them were of a very satisfactory quality, and not so salt as it has hitherto been the custom to make them. The tongues especially showed a very great improvement on those which we have hitherto met with. The tinned poultry and game were all of good quality, and carefully tinned.

Of tinned fruits and vegetables, there were some half-dozen instances in which the old system of packing had been carried out, and inferior results had been obtained; but in all other cases, the improvement was so marked, that many of the samples exhibited were decidedly superior to the best of ordinary English produce sold by retailers. We may mention specially pines, apricots, peas, and haricot beans.

Samples of the so-called temperance drinks have been subjected to chemical examination, with the extremely satisfactory result that they all proved to be non-alcoholic and of good quality, and many of those which claim medicinal properties do really possess them.

Of wines, spirits, cordials, and bitters the display was small, but contained a few novelties, and those for which the awards were made, were excellent.

Condensed milk and children's foods show a slight advance on samples with which we have been previously acquainted, but even now there is room for considerable improvement, the sugar present being in our opinion much in excess of that required for the preservation of food.

We think the public, no less than the exhibitors, will be the gainers by the opportunity which has been afforded them of obtaining samples of various articles of food hitherto almost unknown to them. The foundation is well laid for an even larger Exhibition next year.

Among the most interesting of the medals awarded were a gold medal to Messrs. Thurbers, for an excellent show of tinned fruits, and silver medals, among others, as follows:—

For Tinned Meat, to Messrs. Miller & Halls.

For Pure Cocoa Extract, to Messrs. Fry & Sons.

For "Perfécted" Cod Liver Oil and other Pharmaceutical Preparations, to Messrs Allen & Hanburys.

For Gas Cooking Stoves, to Messrs. H. Greene & Son.

For Dairy Produce, to the Aylesbury Dairy Company.

For Whole Meal Bread, to Messrs. Hill & Son.

For Pharmaceutical Preparations, to Messrs. Savory & Moore.

For Prepared Corn Flour, to the Oswego Company.

For Condensed Soups, &c., to Mr. H. W. Brand.

For Crystallized Sugar, to Mr. J. Duncan.

THE LOCAL GOVERNMENT BOARD AND THE SALE OF FOOD AND DRUGS ACT, 1875.

The Local Government Board have just issued their Annual Report for 1879, from which we extract the following:—

It is satisfactory for us to be able to state that, during the past year, a considerable number of additional authorities have availed themselves of the advantages to be derived from a compliance with the provisions of The Sale of Food and Drugs Act, 1875, in regard to the appointment of an analyst. From our last Report it will be observed that up to the 31st December, 1878, arrangements had been made by 201 authorities for the discharge of the duties of this office within their respective Districts, and that we were then in communication with those authorities from whom we had not received any report of an appointment having been made. During the year ended on the 31st of December, 1879, appointments under section 10 of the Act were reported to and approved by us in 84 additional cases, whilst two additional authorities made arrangements, under section 11, for the due discharge of the duties of the office within their Districts.

Up to the last-mentioned date the number of authorities who had appointed analysts under section 10, with our approval, the appointments being then in existence, was as follows:—

County Authorities	52
Municipal Corporations	189
District Boards and Vestries in the Metropolis	39
	280
Agreements entered into under section 11	7
	287

The counties generally are therefore provided with an analyst, and it is satisfactory to observe that a large majority of the boroughs to which the Act applies:—viz., those having separate Courts of Quarter Sessions or separate Police Establishments, have complied with the provisions of the Act in this respect. We have not failed to urge upon the remaining authorities who are empowered to appoint analysts under the Act, the desirability of their adopting a similar course.

The results of the analyses made during the year are shown in the abstract which is printed in the Appendix. It will be seen that the entire number of such analyses is 17,049, which exceeds by about 850 the number recorded in our last report. It would [illegible] doubt have been still larger, if the operation of the Act had not been practically suspended, in a large number of districts, in the early part of the year, owing to some doubt which had been suggested, but in which we did not participate, as to the construction of the words "to the prejudice of the purchaser" in the 6th section of the Act of 1875. As soon, however, as this question was brought before the High Court of Justice (Hoyle *v.* Hitchman L. R. 4 Q. B. 233) it was decided that the words in question did not, as had been contended, defeat the object which the Act had been obviously intended to secure; and thenceforward samples were again submitted to the analysts, and proceedings were again taken in cases of adulteration. The decision of the High Court on this point was subsequently embodied in an Amendment Act, to which we shall presently refer.

The following Table shows the number of samples examined during the year, and the percentage of adulteration. It is necessary, however, to point out that such percentage is based on the results of all the analyses as given in the quarterly reports, and not merely on the number of cases in which legal proceedings were instituted. In many of the samples which are included under the general head of "adulterated," the amount of adulteration was so small that the analyst specially notes "no prosecution advised;" and in some instances prosecutions with regard to samples reported as adulterated eventually broke down because it was shown that adequate notice of the mixture (as of coffee with chicory, or mustard with wheaten flour) had been given to the purchaser.

———	Examined.	Adulterated.	1878 Percentage of Adulteration.	1879 Percentage of Adulteration.
Milk	5654	101	21·6	19·4
Bread	1287	95	7·1	7·3
Flour	601	15	1·8	2·4
Butter	1306	171	12·6	13·0
Coffee	1244	236	18·5	18·9
Sugar	243	1	4·3	0·4
Mustard	922	176	19·5	19·0
Pickles (including Tinned Vegetables)	44	1	7·0	2·2
Jam	52	1	1·9	1·9
Confectionery	257	4	5·0	1·5
Wine	56	6	2·6	10·7
Beer	434	16	5·0	3·6
Gin	601	131	47·0	21·7
Spirits other than Gin	725	224	46·1	30·8
Drugs	613	171	25·4	27·8
Other Articles	3010	186	5·5	6·1
Total	17049	2535	17·2	14·8

It will be seen from this Table that the percentage of adulterated samples, which was 19·2 in 1877, had fallen from 17·2 in 1878 to 14·8 in 1879; but it must be pointed out that some of this diminution is more apparent than real; for it is due to the fact that the standard of strength for spirits fixed by the Sale of Food and Drugs Amendment Act is considerably lower than that previously adopted by Public Analysts in general, and thus many samples which would have figured as adulterated in 1878 appear as genuine in 1879. If we exclude spirits altogether from consideration, we find that the percentage of adulterated samples was 15·5 in 1877, 13·7 in 1878, and 13·8 in 1879.

About one-third of the whole number of samples examined were of milk, and we are glad to find that the improvement which we noticed last year has been continued, though by no means to the extent that we desire. The percentage of adulteration has sunk from 21·6 in 1878 to 19·4 in 1879, and in the Metropolis from 25·4 to 23·3.

The proportion of adulterated samples of milk varies much in different districts. As regards the Metropolis, we find that in Hackney 19 samples out of 46 are reported as adulterated; in Fulham 17 out of 42; in St. Pancras 33 out of 93; in Kensington 13 out of 46; in Paddington 16 out of 66; while of 67 samples procured in St. James's, Westminster, and of 22 samples procured in Limehouse, all are pronounced genuine. As regards the large provincial towns we find that Birmingham has the enormous proportion of 37 adulterated samples out of 62 examined; Manchester 18 out of 52; Liverpool 32 out of 160; Bristol 50 out of 240; Sheffield 3 out of 23; and Leeds 2 out of 34.

It would be interesting to learn how far these differences accurately represent the relative advantages and disadvantages of the respective districts as regards milk supply, and to what extent they depend on the system of procuring samples, or on other conditions. Sometimes, indeed, science is called to the aid of the adulterating milkman, as in the caes of a sample where just such an amount of sugar had been added as would bring the sample up to the specific gravity of genuine milk; or where an alkali had been introduced to conceal the badness of the milk that had become sour. Generally, however, water alone is employed, sometimes with profusion, sometimes in just such quantity as to reduce fairly rich milk to a fluid which it is hoped may at any rate pass as the product of ill-fed cows. Thus one sample examined by the analyst for Southampton contained no less than 48 per cent. of added water, while another, examined by the same analyst, was apparently of rich milk skilfully reduced to the limit. And the fact, to which we referred in our Report of last year, that the present state of science does not enable analysts to distinguish with certainty exceptionally poor, but genuine, milk from originally rich milk to which water has been added, no doubt prevents them from reporting against many samples which there is much reason to believe have been thus tampered with. In the interests of the public it is desirable that in those instances where the milk is so far below the average strength as to give rise to suspicion of its having been watered, but to suspicion not amounting to certainty, further samples of the milk sold by the same person should from time to time be taken and submitted to the analyst.

In some cases the plan adopted at Salford might be followed. There, whenever a sample of milk is found to be adulterated, the inspector at once inquires whence the vendor obtains his milk; a sample is then procured from the wholesale dealer, and if that is found to have been tampered with, then the inspector obtains samples from the can of the farmer who supplied the milk, immediately on its arrival in Salford. The analyst states that if this corresponds to the former samples, he makes a point of seeing the cows milked, and analyses a sample obtained in his presence, so as to leave no chance of an innocent person being convicted. He adds that the inspector has taken several samples on Sunday when the milkmen thought he was in church, and that one of the samples of milk obtained on that day contained as much as 35 per cent. of water.

This last proportion is no doubt unusually large, but in the majority of cases entered as adulterated in the return it would seem that the addition of water has been very freely made; and the entire money loss sustained by the consumers, to say nothing of the loss of nutriment, must amount in the aggregate to an enormous sum.

Anything like an exact estimate of such loss is, of course, out of the question. If, however, we assume that in London each person consumes only a pint of milk weekly, or rather over half a quarter of a pint daily (and this, considering that over one-eighth of the entire population consists of children under five years of age, is probably a moderate estimate), the yearly consumption of the Metropolis * alone will be found to amount to nearly twenty-three millions gallons a year, representing, at 5d. a quart, an expenditure not far short of two millions sterling. If nearly a quarter of this milk be adulterated with about 16 per cent. of added water (and this seems from the analysts' reports to be the average proportion), it follows (on the hypothesis that the samples analysed are fairly representative of the entire supply) that Londoners are paying between £70,000 and £80,000 a year for water sold under the name of milk. This unremunerative outlay might certainly be diminished with advantage, by the more extended use of the Sale of Food and Drugs Acts.

It may be further observed that persons who adulterate are not likely to be very particular as to the quality of the water which they use for the purpose; and this is the more important, considering the part which water has been frequently shown to play in the dissemination of infectious disease. It is to be hoped, therefore, that in districts in which the Act has hitherto been allowed to be inoperative, active steps will be taken to check the adulteration of this article of universal consumption.

Of the bread examined it will be seen that, as in previous years, about 7 per cent. of the samples are reported against, and of flour about 2½ per cent. The usual adulterant is alum, and there has been in some instances a difference of opinion among analysts as to whether samples containing a large proportion of alumina had in effect been adulterated with alum or not. From a Report of the Chemists of the Inland Revenue Department, which has been laid before us, there seems to be no doubt that some descriptions of flour, especially that made from Egyptian wheat, contain appreciable quantities of clay, which cannot be separated by the miller, and it is most important that analysts should be careful to distinguish between accidental impurity of this kind and wilful adulteration. For this purpose it is represented in the report in question as necessary that they should not omit to use such tests as will determine whether the alumina be present in an insoluble condition, as it would be if derived from earthy matter, or in a soluble form, as it would be if existing as alum.

The sale of butterine in the place of butter is apparently on the increase, and is no doubt commonly effected without notification to the purchaser. Correspondence on the subject of the manufacture in the United States of this article (which is also known as Bosch and Oleo-margarine, and is produced from beef fat) was forwarded to us by the Board of Trade, and has subsequently been published as a Parliamentary Paper. From a despatch from her Majesty's Consul General in New York, dated the 16th September, 1879, it appears that the total quantity of "Oleo-margarine" exported from New York amounts to about 6,000,000 lbs. annually, of which the greater part is shipped to Rotterdam, Hamburg, and Bremen, where it is mixed with milk and colouring agents to give

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* Through the courtesy of the various Railway Companies we have received returns from which it appears that the quantity of milk brought to London by railway now amounts to nearly twenty million gallons annually. If we assume three million gallons as produced within the Metropolitan area, or brought thither otherwise than by railway, the entire consumption would correspond with that estimated in the text. We cannot find that any statistics on the subject have been previously collected.

it a resemblance to butter, and is then churned and converted into butterine, and reshipped, chiefly to this country. Reports and chemical analyses demonstrating its perfect wholesomeness and its extreme unwholesomeness appear side by side in the paper referred to. Its opponents assert that samples have been found invested with organisms of a parasitic character, which may be transferred in a living condition into the systems of those who make use of it. On the other hand the Board of Health of New York pronounce it to be a "good and wholesome article" of food. In this country a Public Analyst of high reputation is of opinion that "the public should know that genuine butterine, which can be purchased retail at less than 1s. a pound, is often more palatable and more digestible than the inferior Canadian and other butters which are washed up and prepared for the English markets, and sold at a little higher price." However this may be, it is desirable that butterine should not be sold as butter; and proceedings taken under the Sale of Food and Drugs Act in relation to it will conduce to this end.

The percentage of adulterated samples of coffee continues high, mainly in consequence of the practice of selling mixtures of chicory and coffee as coffee, without adequate notification to the purchaser. Of course the mixtures duly labelled as such are not classified as adulterated. It may be interesting to observe, however, that one such mixture, on being analysed, was proved to consist of 90 per cent. of chicory and only 10 per cent. of coffee.

As to the adulteration of mustard, the observations in our last Report still apply. For table purposes, probably many people would not prefer ground mustard seed to the preparations ordinarily sold as mustard, which consists for the most part of mixtures of mustard flour, wheat flour, and a little turmeric. Such preparations, however, if sold as mustard without notification to the purchaser, are classified as adulterated.

Of sugar only one sample was found adulterated out of 243 examined; and experience seems to show that this article is very little tampered with, and that the practice of "sanding the sugar," if it existed in the times of heavy duties and high prices has now been virtually abandoned. Of jam, the one adulterated sample was reported to be extensively composed of seaweed. Of confectionery, all but four samples out of 257 are returned as genuine, from which it may be inferred that the use of poisonous colouring matters is now rare. In one or two cases, however, chromate of lead appears to have been used for this purpose; and in one instance a sample of sweets, sold as "cider cream," was found to consist of strong vinegar, flavoured with a little acetate of amyl, as to which the analyst remarks, that he is "not suprised to hear that an uncomfortable feeling is experienced in the stomach after drinking so delectable a compound."

Of wines, it will be seen that only 56 samples have been examined, and it should be stated that three out of the six reported against were sold as "unfermented wines," and consisted of sugar, water, and tartaric acid, with a little flavouring and colouring matter. Other "unfermented wines" was found to be pure grape juice, mixed with a small quantity of sugar.

The adulteration of beer seems of late years to have been steadily on the decrease, the percentage of adulterated samples having fallen from 9·3 in 1877 to 5·0 in 1878, and 3·6 in 1879. In the Metropolis, moreover, only one sample out of 98 examined in 1879 was found to be adulterated. In a single instance a trace of tobacco was found, but excess of salt was generally the ground of condemnation. On this point we may refer to the remarks in our report of last year, merely adding that salt seems to be occasionally employed, not, as suggested, for the sake of inducing thirst, but with the notion of making beer keep the better for it.

As regards spirits it may be said that the adulteration continues to be of an innocuous character, only water being usually added. In comparing the percentage of adulterated samples with that shown in the returns for 1878, it must be borne in mind that, as we have stated above, the standard fixed by the Amendment Act of 1879 is a low one (as any standard of minimum strength must necessarily be), and that much which was before generally ranked as diluted spirit may now be sold as genuine.

We regret to find that drugs continue to be largely adulterated, no less than 171 samples being reported against out of 613 submitted to analysis. One result of adulteration of drugs is that a person habituated to the use of a certain medicine in an adulterated state, may be seriously affected by suddenly taking the genuine article. Thus "paregoric" is a popular domestic medicine, practically identical with the officinal preparation formerly called compound tincture of opium, of which opium is the leading ingredient. Certain samples, however, of so called paregoric which were analysed in Derbyshire, contained no opium whatever, and large doses might be habitually taken without producing the sedative effect desired, whereas if the patient were suddenly supplied with genuine paregoric, and were to take it in the quantities to which he had been accustomed, the change might be attended with unexpected and possibly disastrous results. Similarly, in the case of sweet spirits of nitre, some samples were found entirely destitute of the nitrous ether which is the most important constituent of the real compound, and others were diluted with amounts of water varying up to 40 per cent. of the whole. Cream of tartar has been found largely mixed with sulphate of lime; and tartaric acid with lead in quantity sufficient to injure health. Fluid magnesia has been reported to have only 2·8 grains of magnesia per fluid ounce, instead of the 5 grains which is the proper proportion; and tincture of rhubarb bought at one shop has been found of scarcely more than half the strength of that bought at another. We must repeat the opinion which we have expressed in former years that this state of things demands serious attention, and that strong efforts should be made to secure the sale of genuine drugs of proper strength.

Of the articles not specified by name in the Table, we may particularise, among those broadly classified as adulterated, samples of infants' food, of sardines, and of ærated waters, which contained lead in greater or less proportion. The introduction of this substance in the processes of manufacture had been doubtless unintentional, but was not the less unwholesome on that account. In the case of the ærated waters the analyst for Newport (Mon.) observes that "lead is a cumulative poison, and as it is somewhat readily acted upon by prepared water charged with carbonic acid gas, this metal should not be used in the construction of the apparatus employed." He further reports, what has been observed in many instances elsewhere, that some of the samples of so-called "soda water" contained no alkali whatever, but consisted simply of water charged with carbonic acid gas.

In several cases the specimens of vinegar analysed were found to be infested with immense numbers of particularly active animalcules, known as vinegar-eels; and in one instance hydrochloric acid was reported to have been added to vinegar.

Of the 17,049 samples above referred to, the greater part were purchased by officers appointed under section 13 of the Act of 1875, and only 528, or little more than 3 per cent., by private individuals. It is significant that in the latter class of samples the proportion adulterated is 25 per cent., compared with 14·5 per cent. in the former. In some articles the difference is especially marked. In milk, for instance, of the 176 samples procured by private purchasers, no less than 80, or 45·5 per cent. were adulterated; while of the inspectors' samples the proportion was 18·6. Of course this difference is mainly to be accounted for by the fact that a private individual does not, as a general rule, take the trouble and incur the expense of submitting a sample for analysis, unless he has very strong grounds for suspecting adulteration. But there is reason to believe that in some cases the inspectors appointed under section 13 are known to the tradesmen, and are supplied, when recognised, with articles superior to those which would be sold to an unofficial customer. An illustration of the practice referred to is furnished by the analyst for Cumberland, who reports that a sample of milk "contained such an abnormally high percentage of cream as to suggest the idea that the vendor, knowing the purpose for which the milk was bought, determined to supply the inspector with a good article, and added a considerable proportion of cream to it." No doubt in some cases adequate precautions have not been taken to ensure that the articles purchased on behalf of the Authority are fair specimens of those usually sold to the public; and difficulty in this respect has perhaps occasionally arisen from an erroneous assumption that the officers authorised under section 13 of the Act must personally make the purchases, and that, therefore, in order to escape detection, an adulterating tradesman has only to make himself acquainted with the officers so authorised. We may, however, observe that there is nothing in the Act to prevent the inspector from taking proceedings under it when the actual purchase has been made, not by himself, but by a substitute; and as a matter of fact, it is not an infrequent practice of inspectors to adopt this course.

We may refer with satisfaction to the passing of the Sale of Food and Drugs Amendment Act of 1879, to which we called the attention of the Authorities in our circular letter of the 31st December last, and which has effected some important amendments in the law. By expressly declaring that when an article may have been purchased solely for analysis, it shall be no defence to allege that the purchaser was not prejudiced thereby, it disposes of the objection to which we have previously referred, as for a time interrupting the administration of the principal Act; and it also enacts that it shall not be a good defence to prove that the article analysed, though defective in nature, or in substance, or in quality was not defective in all three respects. It makes special provision for procuring samples of milk in course of delivery, under contract, to the purchaser or consignee, and it is hoped that this enactment, by making the consignor liable to a penalty, will afford to dairymen protection against the consignment to them of adulterated milk. A further amendment of the principal Act is made by the clause which extends its operation to articles sold in the streets.

The difficulty, on which we enlarged in our last Report, of determining, in the absence of a recognised standard, the precise point at which a compound of alcohol and water ceases to be spirit and becomes spirit-and-water, has been finally disposed of by the provision that the sale of spirits, to which only water has been added, shall not constitute an offence under the 6th section of the principal Act, if such admixture has not reduced brandy, whisky, or rum, more than 25°, or gin more than 35°, under proof. In one or two instances it seems to have been assumed that this amending provision operates to prohibit altogether the sale of spirits under the standard strength, but we have had no hesitation in expressing our opinion that the clause in question does not affect the operation of section 8 of the principal Act, and that the vendor of any spirits reduced by water below the standard strength would not be guilty of an offence under the last-named Act, if he could show that adequate notification of the dilution had been given to the purchaser.

Other clauses effect certain changes in the incidence of the charges of the execution of the Acts, and make special provision with regard to the time within which a summons is to be served, and also with regard to the period to be allowed before such summons is returnable.

We trust that under the law as it now stands, it will be found practicable still further to reduce the amount of adulteration. The progress already made is substantial, and would, no doubt, be much accelerated, if private individuals would avail themselves more largely of the legislative provisions for their own protection.

The following is a list of the total number of samples, examined and adulterated, in England and Wales, during 1879 :—

TOTAL NUMBER OF SAMPLES.

	Examined.	Adulterated.	Proportion adulterated.	
			1879.	1878.
The Metropolitan District	4595	585	12·7	12·6
COUNTIES.				
Bedford	288	35	12·1	7·7
Berks..	153	12	7·8	8·1
Bucks	4	0	0·0	0·0
Cambridge	78	19	24·3	25·8
Chester	670	103	15·3	27·9
Cornwall	7	3	42·8	26·6
Cumberland	111	14	12·6	62·5
Derby	104	31	29·8	21·1
Devon	80	21	26·2	13·5
Dorset	—	—	0·0	—
Durham	678	202	29·7	16·6
Essex	216	14	6·4	71·4
Gloucester	765	58	7·5	7·8
Hereford	—	—	0·0	—
Herts	3	3	100·0	14·6
Hunts	3	0	0·0	—
Kent	389	108	27·7	18·1
Lancaster	2037	356	17·4	24·7
Leicester	257	25	9·7	11·1
Lincoln	322	53	16·4	26·5
Middlesex	69	16	23·1	23·1
Monmouth	116	29	25·0	33·7
Norfolk	24	7	29·1	33·3
Northampton	157	25	15·2	21·0
Northumberland	181	23	12·2	38·8
Nottingham	63	12	19·0	19·4
Oxford	28	7	25·0	46·2
Rutland	—	—	—	—
Shropshire	9	0	0·0	17·6
Somerset	956	54	5·6	11·0
Southampton	528	111	21·0	26·2
Stafford	1072	137	12·6	15·9

	Examined.	Adulterated.	Proportion adulterated.	
			1879.	1878.
Suffolk	1	0	0·0	—
Surrey	528	70	13·2	22·4
Sussex	427	43	10·0	14·7
Warwick	271	62	22·8	22·6
Westmoreland	6	1	16·6	45·9
Wilts	35	2	5·7	15·4
Worcester	185	23	12·4	16·1
York, E. Riding	159	29	18·2	21·8
„ N. Riding	132	19	14·3	17·8
„ W. Riding	707	149	21·0	16·9
WALES.				
Anglesey	13	2	15·3	7·4
Brecknock	59	39	66·1	—
Cardigan	—	—	—	32·3
Carmarthen	35	6	17·1	28·1
Carnarvon	—	—	—	—
Denbigh	4	1	25·0	—
Flint	27	2	7·4	—
Glamorgan	482	25	5·1	9·7
Merioneth	—	—	—	—
Montgomery	1	0	0·0	—
Pembroke	—	—	—	—
Radnor	—	—	—	—
Totals	17049	2535	14·86	17·18

ANALYST'S REPORT.

Mr. J. Carter Bell, Analyst for Salford, in his quarterly report states:—During the quarter ending September 30, 1880, I have examined 154 samples. Of these 24 were adulterated, consisting of 9 milks, 9 wines, 5 breads and 1 butter. The five breads contained a chemical compound which is known by the name of baker's mixture. This is now being sold in Salford to bakers for the purpose of mixing with inferior flour. It is made from phosphates of alumina, lime and magnesia, with sulphuric and hydrochloric acids, and I have found that it has the effect of spoiling the bread, and making it injurious to health. It also contained a considerable amount of arsenic, the consequence of its being made from impure materials. I need not say how dangerous it is to introduce such a mixture into bread. I have also examined nine samples of so-called unfermented wines and two of ordinary tent wines. Of these nine samples, three bearing labels stating that the bottle contained "pure grape juice," "virgin fruit of the vine," &c., consisted of sugar, tartaric acid, salicylic acid and colouring matter with a considerable quantity of copper —the result doubtless of ignorant or careless manufacture. Grape juice was in my opinion entirely absent. Another sample, labelled "Pure and genuine unfermented fruit of the vine," was evidently a composite article artificially made, and so carelessly prepared as to contain alchohol. One sample of unfermented wine imported from abroad contained some grape juice, but the presence of alcohol and an abundance of yeast cells showed that fermentation had not been arrested. One example was labelled "The Selected Wine of the Temperance Fraternity." This was an ordinary low class fermented wine containing a large amount of alcohol. Of the nine samples of the so-called unfermented wines only one was genuine, and what it professed to be, "Pure grape juice entirely free from alcohol." The samples of tent were sweet and highly alcoholic wines, one sample containing as much as 40 per cent. of proof spirit. This wine had evidently been strongly brandied, no natural wine containing anything like this proportion of alcohol. The number and variety of these so-called unfermented wines testify to a large demand for articles of this class, but my examinations point to the necessity of a very careful discretion in their selection. Three samples of water taken from the lodge of a manufactory were so highly contaminated with sewage matter as to make them dangerous to health. The report was adopted.

LAW REPORTS.

What Addition of Water Constitutes Adulteration :—

Thomas Noddle, a milk dealer, of Mount Street, Leeds Road, Bradford, Yorks., was recently summoned for selling adulterated milk. The town clerk, Mr. W. T. McGowen appeared in support of the summons, and Mr. Berry represented the defendant. Inspector Chambers said that on the 6th September, he went to the defendant's house and purchased a pint of milk from Noddle's daughter. He submitted the sample to Mr. Rimmington, Borough Analyst, who certified that in his opinion the milk had been adulterated by the addition of 5 per cent. of water. In cross-examination by Mr. Berry, witness said that he gave a penny for the pint of milk. The girl did not tell him it was Sunday's milk. For the defence Mr. Berry called the defendant's daughter, who stated that Inspector Chambers asked her for a pint of new milk, but that she told him they had no new milk, and gave him some of the previous day's, which had had the cream skimmed off. The Chairman said it was drawing the matter very finely to prosecute when the milk was adulterated to the extent of 5 per cent. only. The summons would be dismissed. The Town Clerk said he would ask the Bench if he was to understand that where milk was adulterated to the extent of not more than 5 per cent. it would be necessary for him to bring cases into Court. The Chairman stated that the Bench were divided in their opinion as to the present case. Mr. Gurney was of opinion that an addition of 5 per cent. of water was adulteration, whilst he (the Chairman) believed that the thinness of the milk might be caused by poor pasturage. Mr. Gurney said that if the analyst were to come into Court and swear that five parts of water in 100 had been added to the milk, he would feel no hesitation whatever in convicting. He considered that a man had no right to adulterate a little any more than he had to adulterate a great deal. The Town Clerk again asked for their Worships' instructions as to what course he should adopt in similar cases in future. Mr. Berry complained that the Town Clerk was trying his best to terrorise the Bench. Mr. Mossman explained that the summons was dismissed because the Bench were divided in opinion.

MIDDLESEX SESSIONS.

Analyst's Certificate as to Milk must be in Exact Words of Act as to No Change having taken place in Sample. Conviction on Certificate not so Worded, Quashed on Appeal :—

This was an appeal by Mr. Peart against the decision of the Clerkenwell police magistrate. Mr. Besley was counsel for the appellant; and Mr. Mead for the respondent, the sitting magistrate at Clerkenwell. The appellant, Mr. Isaac Peart, farming 600 acres in Hertfordshire, and having a herd of about 80 cows, supplied every morning two churns to Mr. Edwards, a milk dealer of Fonthill Road, Finsbury Park. The price was 1s. 9d. for 17 pints, which is a "barn" gallon, and the seller paid carriage to Finsbury Park station, receiving payment for the milk supplied every fortnight. This arrangement had been in existence about two years, and on the 6th of July, on the arrival of the churns at Finsbury Park Station, Mr. Edwards caused one to be sealed, and telegraphed to Mr. Peart that at six o'clock in the the evening samples for analysis would be taken. Mr. Peart's son attended, and the samples were taken. On the 7th of July, Dr. Tidy, the Public Analyst, received one sample, and on the 12th of July gave a certificate that he found 17 per cent. of added water. On the 24th of July, Parish, who is employed by the Dairymen's Protection Association, to which Mr. Edwards belongs, visited Mr. Peart at his farm, and on the 28th of July a summons was taken out for the offence under section 6 of the Act of 1875, in which Mr. Edwards was described as the prosecutor. The hearing was on the 11th of August, and Mr. Barstow decided against several legal objections, and fined Mr. Peart the *maximum* penalty of £20 and costs. Against this conviction the appeal was brought. The case was partly heard on Saturday, the 16th October, and adjourned until to-day (23rd), when, at the conclusion of the evidence for the respondent, it was decided upon a point of law, and Mr. Peart and his witnesses were not called, and the merits, as far as Mr. Peart was concerned, were not gone into. The objection was this. The Act of 1875 requires a number of conditions precedent to the taking proceedings for any penalty, and one is that when the Public Analyst has issued his certificate the purchaser may take proceedings, and must take them in a reasonable time, and the certificate must "specify whether any change had taken place in the constitution of the article so as to interfere with the analysis." Dr. Tidy having certified that the milk was fresh when delivered to him, omitted to report specially as required.

Mr. Besley submitted that the summons having issued, and the adjudication followed upon an informal certificate, the conviction could not be sustained.

After hearing Mr. Mead, *contra*, and considering their decision in private,

The Assistant-Judge said that the very precise provisions of the statute with respect to the certificate of the analyst—requiring a "special report" as to certain matters—were obviously intended for the protection of the seller. Those provisions would be practically a dead letter, if an informal and *insufficient certificate*, such as that upon which the conviction proceeded in the present case, might be amended and supplemented by *viva voce* evidence given upon an appeal heard possibly several months afterwards. The conviction would, therefore, be quashed, but as the omission was that of the public officer, there would be no order as to costs. Several prosecutions for selling adulterated milk having failed recently in consequence of similar informality, the Assistant-Judge expressed the wish of the Bench that their decision in this case would lead to a more strict observance of the requirements of the statute. Conviction quashed without costs.

NOTES OF THE MONTH.

There is really nothing to note this month except the amusing exposure of so-called "temperance wine," which, it seems, is tartaric acid, sugar and salicylic acid, and colouring matter. Some few samples, which really contained grape juice, had fermented in the bottles or casks, and so were distinctly alcoholic. We believe an attempted prosecution broke down on the point that, because tartaric acid existed in grapes, therefore it might be said to be really although indirectly produced from grapes.

Here is a true story of the failure of a prosecution which had better be studied by inspectors. A man was summoned for selling adulterated milk, and the usual evidence was taken; but the inspector forgot to say that he paid for the article. Then the defence counsel says, quietly addressing the prosecutor, "Is that your case, Mr. —— ?" "Yes." "Very well; I object that my client is summoned for selling milk, and there is no evidence that it was sold before the court. *Prosecuting Counsel:* "Oh, I will soon set that right." *Defending Counsel:* IT IS TOO LATE, *you said your case was closed.*" And it *was* too late, and the milkman never forked out any money with so much joy as that which he handed to his counsel.

Here is another hint to inspectors. A milkman, about to deliver milk at a large parochial establishment, suddenly notices the inspector lying in wait to demand a sample. and so off he drives. The inspector follows, and about 100 yards away he arrests the horse and insists on a sample, which was found to be somewhat more than half water. But in court the case breaks down because the Act says the sample shall be taken at the place of delivery, and this was obtained 100 yards away! So inspectors sent to catch a man delivering at a certain place may, in future, save their legs and wind, for it is no use trying to take the sample if he once drives off before they have time to demand it at the place itself.

We commend to the careful attention of all Public Analysts the important decision (reported on another page) by the magistrates at the Middlesex Sessions, and especially the remarks of the Assistant Judge in giving the decision. The analyst had stated in his certificate that a milk was quite fresh when brought to him, that he analyzed it immediately, and that it contained 17 per cent. of added water. This might have been considered by most people a reasonable compliance with the provisions of the Act, but the vendor, who was convicted and fined, appealed, and the conviction was quashed on the ground of the exact words of the Act not having been used, that "no change had taken place in the constitution of the sample that would interfere with the analysis." Of course the legislature *may* have intended that these exact words should always be used, and not words to a similar effect, though we have our doubts about such an intention; but as this appeal decision will, no doubt, govern all future cases, it behoves all Public Analysts to be more careful in future, and adhere literally to the strict letter of the law.

PUBLIC ANALYST FOR MONTROSE.—At a meeting of the Public Commissioners of Montrose the chairman pointed out that, notwithstanding the fact that the Sale of Food and Drugs Act had been in force since 1875, no steps had been taken by the Board to put it in force in the burgh. He thought it was high time that something should be done regarding it. In other burghs in Forfarshire the question had been taken up, and persons who had infringed the Act had been punished; and he thought there was nothing more diabolical than the adulteration of food and drugs. The attention of the Superintendent of Police had been directed to the matter, and a report upon it from that gentleman was submitted to the meeting. After some discussion it was resolved to appoint Mr. Macdougald, Dundee, Public Analyst for the burgh on the same terms as were paid him by the Forfar authorities—namely, 7s. 6d. for each sample analysed by him, and a guinea per day, besides travelling expenses, when giving evidence in court.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1880 No.	Name of Patentee.	Title of Patent.	Price.
73	W. J. Menzies	Utilizing Caustic Soda for Household Use	2d.
791	A. P. Chamberlain	Manufacture of Gas	6d.
804	C. Von Buch	Crystallization of Carbon	2d.
830	C. Von Buch	Obtaining Crystallization of Carbon	2d.
832	R. T. Brougham	Electric Lamps	6d.
842	A. M. Clark	Producing Electric Light	6d.
847	J. H. Wolfram	Production of Collodio-Bromide of Silver Emulsion	4d.
849	H. J. Haddan	Dynamo-Electric Machines	6d.
850	D. H. Dade	Application of Silicate Cotton or Slag Wool to various purposes	6d.
861	W. Spence	Refining Saccharine Vegetable Juice, Muscovy Sugar, &c.	4d.
872	D. G. Fitzgerald	Magneto-Electric and Dynamo-Electric Machines	6d.
896	J. P. Rickman	Manufacture of Ammonia and its Compounds	6d.
907	F. H. Engel	Husking or Decorticating Corn	6d.
917	W. R. Lake	Manufacture of Preserved or Condensed Milk	4d.
925	J. H. Guest	Electric Lamps	6d.
941	R. H. Courtenay	Telephonic Apparatus	2d.
1151	R. H. Courtenay	Muro-Telephonic Apparatus	2d.
952	S. Pitt	Manufacture of Steel	2d.
967	S. Clift	Manufacture of Coal Tar Products	2d.
976	W. Jones and J. Walsh	Furnaces for Manufacture of Sulphates of Soda & Potash	6d.
987	Sir H. and A. G. Bessemer	Treatment and Manufacture of Iron	8d.
993	W. J. Williams	Treatment and Manufacture of Phosphates	4d.
1004	J. H. Johnson	Production of Cyanides of Metals of Alkaline Earths	4d.
1019	T. Twynan	Manufacture of Magnesia	2d.
1032	J. Wadsworth	Utilizing Excrementitious Matter	8d.
1034	E. Edmonds	Carburetting Air	4d.
1051	F. M. Lyte	Treatment of Ores, &c.	10d.
1058	H. Wiggin and A. S. Johnstone	Treating Nickel and Cobalt	4d.
1078	A. Chapman	Apparatus for Recovering Soda Ash from Waste Liquors	6d.
1081	F. H. Higgins	Obtaining Ammonia and Ammoniacal Salts from Urine, &c.	6d.
1086	J. H. Johnson	Telephonic Apparatus	2d.
1088	F. G. Harvey	Treating Cane Juice for Evaporating Purposes	6d.
1119	W. Foulis	Purifying and Cleansing Gases	2d.
1136	J. H. Johnson	Magneto-Electric and Dynamo-Electric Machines	4d.
1149	S. Pitt	Manufacture of Zinc White and Metallic Zinc	6d.
1178	J. Perry	Dynamo or Magneto Electric Machine	6d.
1239	E. Quin	Composition as a Substitute for India Rubber	2d.
1259	J. H. Johnson	Electro-Magnetic Motors, &c.	6d.
1266	C. D. Abel	Clarifying and Drying Loaf Sugar	6d.
1298	C. D. Abel	Manufacture of Wrought Iron	4d.
1286	J. H. Johnson	Telephones	6d.
1305	W. R. Lake	Treating Woven Fabrics	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper *and Dairyman's Journal*; The Chemists' Journal.

THE ANALYST.

DECEMBER, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held at Burlington House, Piccadilly, on Nov. 17. In the President's absence, the chair was taken by Vice-President Dr. Blyth.

The minutes of the previous meeting were read and confirmed.

Mr. Hehner and Mr. Hobbs were appointed Auditors to examine the accounts for the current year.

The following gentlemen were proposed for election, and will be balloted for at the next meeting:—W. H. Ellis, M.B., Public Analyst of Toronto, Canada, as a Member; and Mr. W. Bouchier, Assistant to Dr. Bernays, of St. Thomas's Hospital, and Mr. B. A. Burrell, Assistant to Mr. T. Fairley, Leeds, as Associates.

Mr. Hehner read a paper "On the Occurrence of Tin in Articles of Food and Drink."

Dr. Dupré read a paper "On some Points of Water Analysis."

Mr. Wigner gave a short abstract of an essay "On Food Adulteration," which had won a prize offered by the American National Board of Trade.

NEW YORK, Nov. 22.—By Cable.

The Committee of the National Board of Trade of the United States have awarded the first prize of 500 dols. for the best essay and draft of an act to prevent injurious adulteration of food or drugs, and to regulate the sale of food and drugs without imposing unnecessary burdens on commerce, to Mr. G. W. Wigner, analyst and F.C.S., of London. The second prize was awarded to Mr. Davis, analyst, of this city. The Committee also find that no widespread or dangerous adulterations of foods or drugs prevail in America.—*Standard*.

REMARKS ON SOME POINTS IN WATER ANALYSIS.

By A. Dupré, Ph.D., F.R.S.

Read before the Society of Public Analysts, 17th November, 1880.

In the remarks I am about to make there is, probably, little that is new to chemists frequently engaged in water analysis, and I have been induced to bring them forward chiefly in the interest of our younger members.

During the past year I have examined many samples of water which had been purposely polluted by typhoid and other stools, with, or without, the addition of urine. In the course of this work many points connected with water analysis have again strongly impressed themselves on my mind, some of which I will now lay before you.

In the first place, I would caution analysts, most strongly, against the adoption of any general standards of purity, such as are laid down by some chemists. We may, of course, find waters of such absolute purity that we can at once safely pronounce them fit for all domestic uses, but short of this highest purity it is dangerous to rely on any general standards. The only safe standard to go by, in any individual case, is the standard of purity furnished by unpolluted waters of the district from which the sample under examination has come. This, no doubt, is difficult, perhaps impossible, to obtain in every case, but it might be within the power of our Society to furnish such standards for almost every district within the United Kingdom. Referring to the above-mentioned examinations, I may say that I was almost always able to detect, even very minute traces of pollution, if I had a sample of the unpolluted sample water for comparison. The water, chosen for the experiments, however, itself varied so much from week to week that, without such a direct comparison, even considerable amounts of pollution, comparatively speaking, would have escaped detection by the ordinary analytical methods.

Phosphoric Acid.—During the last ten years I have tested every water that has passed through my hands for phosphoric acid, but have recorded the results somewhat roughly only as, none, very minute trace, minute trace, trace, &c., &c., and I am glad to see that this question has been taken up by Hehner and others in a more definite form. The conclusions I have come to are the following:—The presence of more than traces of phosphoric acid is nearly always a sign of pollution, while the occurrence of much phosphoric acid may be taken as an all but certain sign of sewage or similar pollution, more particularly when taken in conjunction with the standard of the district. On the other hand the absence, or comparative absence, of phosphoric acid cannot be taken as proving the absence of such pollution, because phosphoric acid may have been abstracted from the water by filtration through the soil and by other means; its absence, in such cases, may thus merely prove that the soil through which the water has percolated has not yet been saturated with phosphoric acid, or that other influences causing its removal are present.

Permanganate Test.—For many years past I have applied this test to every water analysed, and I have a very high opinion of its value. I know of no test which so certainly distinguishes between unpolluted deep well waters, which often yield analytical results generally indicative of pollution, and even the purest shallow well water. Deep well waters, when really unpolluted, absorb scarcely even a trace of oxygen from permanganate, whereas even the best shallow well waters always absorb a very measurable amount. Were I to be pinned down to the use of a single test I should choose this, and I never report on a water without having applied it.

Heisch's Test.—I can speak, I am happy to say, very strongly in favour of this simple test. I have applied it recently to a number of purposely polluted waters, previously alluded to, as well as to the waters used in their preparation, and I have, in every case, been able to pick out the polluted sample even when the chemical tests had left me in very considerable doubt. The only difference in my mode of applying the test, and that first recommended by Mr. Heisch is, I believe, this: he kept his bottles exposed to the light, but at the temperature of the laboratory; I have kept them at a temperature of between 98° and 100° F. I am still continuing my examination of this test, but meanwhile would most strongly recommend its use to my fellow analysts.

Nitric Acid.—One of our leading water analysts, as is well known, entirely neglects this, in my opinion, highly important feature. Whatever may be said, and truly said, as to the innocuous character of nitrates themselves, they are, without a doubt, *mainly derived* from nitrogenized organic, chiefly animal, matter. In deep well waters, which are above suspicion of pollution from sewage or surface drainage, the presence of nitric acid need not perhaps be taken into consideration; but the case is widely different when we are dealing with spring, ordinary well, or river water. In all such the presence of notable quantities of nitric acid is a sure sign of previous pollution and as, at present at least, we are not able to differentiate between the various kinds of organic pollution, a water in which sewage, or similar pollution can be proved should always be rejected. In this respect the determination of the nitric acid, taken in conjunction with the standard, in this respect, of the water of the district from which the water under examination has come, is of the highest value, and will often lead us to a correct conclusion as to the character of the water. It must be remembered that the rate of oxidation (nitrification) depends on a variety of conditions and a water which at one time contains much nitric acid and little or no organic matter may, under somewhat altered conditions, contain little nitric acid and much organic matter, even though the degree of pollution has been the same in both cases.

Chlorine.—This is one of the few characteristic constituents of sewage which, when once in a water, suffers, as a rule, little or no diminution. The amount of chlorine, therefore, found in a water, when compared with the prevailing standard of the district (not with some fixed standard devised to fit all cases) is one of the very best guides towards the formation of a correct judgment.

Alkalies.—I generally content myself with obtaining a rough notion as to the amount of alkali salts present by a comparison of the total hardness of, and the total dry residue yielded by, the water. In most pure potable waters the greater part of the saline constituents consists of lime and magnesia salts, or in other words, the total hardness accounts for most of the saline constituents. In polluted water this is no longer the case, and in these the total hardness often represents but the smaller portion of their saline constituents. Here again the comparison of any special sample with the prevailing type of the district is of great value. In connexion with this, I may be permitted to draw attention to the fact, pointed out some years ago in Germany, that we may sometimes be able to detect whether the pollution found is due to animal or human urine, by estimating the relative proportions of sodium and potassium present. In human urine sodium is the predominating alkali metal, in the urine of cattle and horses potassium preponderates.

Sample Taking.—In taking a sample, from an ordinary shallow well more particularly, it is advisable to have the well pumped for some time, dry if possible, and to take the sample only after the well has partially refilled. In wells which are not very much used a very great improvement in the quality of the water often takes place while it remains in the well, and the analysis of such a sample may lead us to entirely erroneous conclusions. If expense is no consideration it would be well to take two samples of the water, one before, one after the pumping. A material difference between these two samples would, in itself, be strong evidence against the well.

Lastly.—I would ask analysts not to assume too readily that even a very bad sample of water is perfectly safe after it has been boiled. It is only necessary to remember that the controversy regarding so-called spontaneous generation, which has now been carried on for many years, is due, entirely, to the extreme difficulty of killing all living germs in the fluids experimented on. Would any advocate for spontaneous generations be listened to for one moment if he had simply boiled his solutions in an ordinary tea kettle? I am of course far from affirming that the boiled water is not as a rule more safe than the unboiled water, but its *absolute safety* should not be taken for granted.

P.S.—Since reading the above I find that I have omitted to mention one point I wished to bring forward. The tint produced by the Nessler reagent in the ammonia distillate corresponds, at all events nearly always, with the tint produced in the standard ammonia. This is not, however, the case with the distillate containing the albuminoid ammonia. In this latter the tint produced is occasionally of a decidedly yellower tint than that produced in the standard ammonia, due, perhaps, to the presence of some compound ammonias. Much to my regret I have not, hitherto, noted this down in my laboratory book, but shall do so in future. I mention the point because other analysts may have been more careful in this respect than I have been, and if they would give us their experience it is not improbable that we may gain one more valuable guide through the tangled path of water analysis.

In reply to Dr. Blyth, Dr. Dupré said he had not tried Wanklyn's moist combustion process, but he had tried a somewhat similar one, namely, warming the water for some time with an alkaline solution of permanganate and estimating the amount of permanganate remaining, a test which had been in use in Germany for a number of years. He was not, however, so far, entirely satisfied with the test. Chiefly because he found it almost impossible to obtain an alkaline solution of permanganate which, on heating for some time, did not suffer some decomposition.

Mr. Heisch, in reply to a question from Mr. Harvey, said he always kept his sugar solutions in as bright a light as he could; it makes the growth come on much quicker. He could quite confirm what Dr. Dupré had said as to destroying germs. Boiling did not do so, and he did not find any difficulty in getting his growths almost as easily as if the water had not been boiled.

Considerable discussion then ensued with regard to the suggestion thrown out by Dr. Dupré as to the practicability of obtaining reliable standards of the various water supplies, and ultimately a committee was appointed to arrange the matter and report thereon.

ON THE OCCURRENCE OF TIN IN ARTICLES OF FOOD AND DRINK, AND ON THE PHYSIOLOGICAL ACTION OF TIN COMPOUNDS.

By Otto Hehner, F.C.S.

Read before the Society of Public Analysts, on 17th November, 1880.

In July, 1878 (*Chemical News*, xxxviii., p. 971,) Mr. A. E. Menke first drew attention to the occurrence of tin in canned goods. He detected and determined the metal in pineapple, apples and in lobster. Mr. Menke's results have since been confirmed by other chemists; but as far as I am aware no extended series of analyses has yet been published, with a view to ascertain whether the presence of tin in canned food is exceptional or general.

In the case of acid substances, such as fruits, &c., one might fairly expect a notable solvent action upon the metal, but there appeared but little probability of any such action in the case of neutral or alkaline matters, such as meats, oils and milk. Mr. Wigner, in his several papers in recent numbers of THE ANALYST, does not mention whether he found the samples, upon which he reported, to be free from tin, whilst Mr. Dyer, in a communication to one of the daily papers, expressly states that he did not detect tin in canned meats.

The *method of analysis* I adopted was as follows :—About 30 grammes of the article to be examined were incinerated in a platinum basin, the ash heated with strong hydrochloric acid, the acid for the most part boiled off; about 30 to 40 c.c. water added, boiled and filtered. This alternate treatment with acid and water was repeated, if necessary, until H_2S no longer indicated the presence of tin. The clear and, as a rule, colourless solutions thus obtained were precipitated with H_2S, and the precipitate thus obtained, when necessary, further treated in the usual manner.

The following *vegetable foods* all gave abundant yellow precipitates of stannic sulphide :—

French asparagus, American asparagus, peas, tomatos, peaches (three different brands), pineapple (two different kinds), white cherries, red cherries, marmalade.

In several cases the inner surface of the canister was found much corroded. So considerable is the proportion of dissolved tin in most of the acid fruits, that tin reactions can readily be obtained from two or three grammes of the substances. A metallic taste is sometimes perceptible.

The following *animal foods* were examined :—

Corned beef (five different brands), ox cheek, ox tongue (three kinds), collared head, tripe, oysters, sardines in oil, salmon, salmon cutlets, lobster, shrimps, curried fowl (two kinds), boiled rabbit, boiled mutton, roast chicken, roast turkey, ox cheek soup, gravy soup, sausages, condensed milk (three brands).

With the exception of the sausages the whole of these samples contained more or less tin. The amount found in one of the soups was 35 milligrammes of tin in one pound canister; in a tin of condensed milk 8 milligrammes; in a pound tin of preserved oysters 45 milligrammes, besides a considerable quantity of copper.

The metal is to be found throughout the mass of the liquid soups and pasty curries, but resides chiefly on the outer surface of hard meats, such as corned beef. In many cases the canisters were much discoloured and blackened on the inner surface, but in others the surface of the metal was perfectly bright, although there was an abundance of tin in solution.

From the results given, it appears, beyond doubt, that tin is most readily acted upon by articles of food, vegetable and animal. Vegetable acids dissolve it abundantly, even if the contact be only of very short duration. Several samples of *ginger ale* and *lemonade*, which I have recently tested, gave distinct tin reactions. Even carbonic acid attacks the metal. In aerated waters kept in syphons, the mountings of which consist of pure block tin, the metal is almost invariably found in solution, and on shaking pure tin filings, or tin foil, with carbonated water, a sufficient amount of tin dissolves in a few days to produce a marked colouration with H_2S. The metal dissolves as a stannous compound, and H_2S gives a brown colouration. Now, seeing how frequently aerated beverages are reported to be impregnated with lead, and yet how rarely lead enters into the composition of the pipes and cylinders of soda-water machines as now used; considering further the difficulty of identifying lead when present only in traces, I cannot but believe that in many cases tin has been mistaken for lead. Metallic tin readily precipitates lead from its solutions, and even from tin containing lead acids do not extract the lead until much of the tin has dissolved, and the proportion of lead in the residue has become considerable. Thus from solder lead can be dissolved simultaneously with the tin. I would advise, therefore, in testing aerated beverages for metallic contamination, to oxydise any stannous salt present, by the addition of a few drops of chlorine water, and after the expulsion of the excess of chlorine to test with H_2S. If a *black* colouration be then obtained, and copper be absent, the presence of lead can safely be declared.

It also follows, that there is but little danger to be apprehended from the employment of impure tin for the manufacture of tin plates. The tin effectually protects the lead from being dissolved. It is from the solder that contamination with lead might ensue.

Seeing then the general occurrence of tin in canned foods, and in articles of drink, the question naturally suggests itself,—*Is tin, when taken into the system, injurious to health or not?*

The opinions of toxicologists on this point seem to be somewhat divided, and not very pronounced. Most of the works on the subject do not refer to it at all, whilst Taylor dismisses the compounds of tin in his work on "Poisons" with half a dozen lines. According to Woodman & Tidy (*Forensic Medicine*, p. 229), the chlorides of tin are accredited with being active and irritant poisons. Orfila states that oxide of tin is likewise poisonous, but this assertion has been contradicted by others. Pereira, again, declares that chloride of tin acts topically as an astringent, irritant and caustic, and that when taken as a poison, it causes convulsive movements of the muscles of the extremities and of the face. Some poisoning cases, of old date, are likewise on record, one with fatal result.

No doubt the condition of the compounds of tin would, to a great extent, determine whether or not they would prove injurious. Thus tin chloride might be expected to show physiological action, whilst ignited stannic oxyde from its insolubility would prove harmless. The state of oxydation might also modify any action; thus one would conjecture that stannous compounds would be more active than stannic salts. Under the circumstances obtaining in canisters in which food is preserved, stannous compounds in a hydrated and soluble form would predominate.

The following experiments may prove interesting, especially since the physiological action of the compounds of tin is but very partially studied:—

A half-grown, apparently healthy guinea-pig took with its ordinary food 25 milligrammes of tin in the form of *stannous hydrate*. This had been freshly precipitated, and had not been dried, but was given shaken up in water. There was no apparent effect. The solid excreta contained much tin after the lapse of a few hours, whilst the metal could not be detected in the urine. Two days afterwards the animal took 50 milligrammes of tin, as stannous hydrate. After three hours it appeared ill. Next morning it was dead. The quantity of fæces passed since the administration of the second dose was very small, and the size of the fæces had diminished extremely, about to that of those of a mouse. On dissection the stomach was found practically empty, the colon distended with food, the small intestines empty. The liver, kidneys, lungs and heart were separately examined. They all contained traces of tin, the largest quantity being apparently in the liver. The main part of the dose given, however, remained in the food contained in the colon, so that comparatively little of the oxyde had been dissolved and absorbed. Death therefore had been produced by a far smaller quantity than that administered, and was apparently due to the astringent and irritant action of the metal.

Another somewhat stronger guinea-pig took 30 milligrammes of tin in the form of *stannic hydrate*, also freshly precipitated and moist. As no ill effect seemed produced, another 45 milligrammes was given on the same day. The fæces contained much tin. Next day the animal further took two doses of stannic hydrate of 75 milligrammes in each. A few hours afterwards it appeared ill; its abdomen was distended, whilst the fæces were diminishing in size. Next day the pig seemed quite well again, and took, without apparent ill effect, three doses of 75 milligrammes each. Thus altogether it had in three days 450 milligrammes of tin, as stannic hydrate, without much injury, although the astringent effect of the tin had become visible.

On the day following, when it seemed in perfect health, it took 50 milligrammes of tin in the form of *stannous hydrate*. It was ill next day, and did not take any food until its death, three days afterwards. The few excrements passed during that time were very small, much like those observed in the case of pig No. 1. They contained much tin. The stomach was practically empty; the colon and bowels filled with semi-fluid green offensive matter, containing much tin. The liver contained a notable quantity of tin, and the lungs, heart, and kidneys, traces of the metal.

From these experiments, it appears that whilst stannic hydrate, from its comparative insolubility in gastric juice, is without much effect in the doses given, stannous hydrate, very soluble as it is in dilute acids, is a powerful irritant poison.

The spasmodic twitching mentioned by Pereira was quite pronounced in the case of animal 2.

It would be interesting to ascertain whether tin, when given continuously in small doses, accumulates like lead.

Canned goods are doubtless but rarely consumed so continuously and in such quantity as to be positively poisonous on account of the tin they contain dissolved, although circumstances are imaginable, as on board ship or on Arctic expeditions, under which poisonous symptoms might become pronounced. But even the occasional consumption of such goods, containing as they do a poisonous metal in a soluble form, *cannot but be more or less injurious*. Of the mysterious poisoning cases recently repeatedly traced to canned goods, the tin may possibly have been the cause. Knowing, then, that such articles of food do constantly contain more or less tin, the employment of tin canisters, of tin saucepans, and tin cooking utensils, ought to be much discouraged by Public Analysts and by medical men. The danger may be small, but every item which is inimical to the health of human beings ought to be avoided when once pointed out. On the same principle, we condemn the presence of copper and lead, even in small quantities, in articles of food and drink.

The trade in canned goods is one of enormous magnitude, and the subject of the purity of these goods is one proportionally important. Surely, human ingenuity will devise means to protect the substance of the canisters from being attacked and corroded by the contents. Such protection has already been attempted more than once, many of the French preserved vegetables being put up in canisters varnished on the inner surface. The varnish is, however, burnt away on the seams during the closing of the tins, leaving the solder exposed, and thus not only tin, but lead, is frequently found in the contents of such "protected" goods.

Dr. Wynter Blyth said it struck him as possible that Mr. Hehner had rather too readily assumed that the tin in the meat and the vegetables he had examined was in a soluble form, but it was he (Dr. Blyth) thought more likely that very minute particles of tin had been rubbed off by the mere friction of the vegetable or meat, and therefore if it was of frequent occurrence in tinned meats, they had to deal with the question of whether tin in a metallic state was poisonous. When he was in medical practice he frequently gave metallic tin in a finely divided state, and he had certainly never seen any bad action follow. He had given at least 350 milligrammes in a finely divided state, and seen no deleterious action arise from it. With regard to the black precipitant it was well not to be too hasty in putting down that as lead. He had always found considerable difficulty in discriminating between dark discolouration when there was only that to work upon, and that was all there was when there was a mere trace in water. With regard to the symptoms about the excrement being small, it struck him as being on account of the loss of appetite.

Dr. Dupré said that in lemonade the lead was traceable to the citric acid used, where, although the action of the lemonade on the vessel in which it was contained was slight, it was nevertheless almost impossible to get citric acid or tartaric acid free from lead.

Mr. Dyer said that the letter, to which Mr. Hehner had referred, was written just after an inquest on a child, who had died from eating poisonous tinned meat (or supposed so). Everyone who had tasted it had experienced symptoms of poisoning. The medical man who attended the child did not appear to have made any analysis either of the meat or of the stomach, but he expressed an opinion that the death was due to metallic poisoning, and suggested that it was owing to the hydrochloric acid used in the process of soldering having dissolved some of the tin. He had also had another case, of ox tongue. Cases of poisoning were by no means confined to *tinned* meats, many cases happened with untinned—for instance, with sausages. Referring to another point, he wished to ask if any member had had any experience in finding the presence of small quantities of zinc. He had had cases of water being contaminated with small quantities of zinc, evidently derived from galvanic tanks. He wanted to know what quantity was considered dangerous. The point seemed rather obscure.

Mr. Wigner said, having had much experience in all kinds of canned goods, he was sure that 20 or 30 milligrammes of tin in the pound could be detected by the taste. He had as yet only found one sample of canned fish which was free from tin present in the fish. This was a tin of prawns, and they had probably been canned less than a month. He did not think that in the case of fish it was merely as Dr. Blyth had suggested, the mechanical adherence of the tin. In nearly every case condensed milks, which had been kept more than a month or six weeks, tin and lead were both present. As to the meats, he had during the late Food Exhibition examined something like 50 different brands of Tongues, Hams, Chicken, Corned Beef, Roast Beef, &c., and there was only one tin (or brand) in which tin was present in any appreciable quantity; equal to about 0·5 milligrammes in the pound *instead of* the 10 milligrammes spoken of by Mr. Hehner. He believed the solder, used to fill up the blow holes of the tins, most frequently contained bismuth, and that was at the bottom of the galvanic action which was set up. In the last number of THE ANALYST he referred to a very old can of meat, which was free from tin. With regard to canned fruits he had tried more than 300 varieties, and only about 8 or 10 had turned out bad. He thought an alteration in the character of the tin, or rather of the tinning, would meet the difficulty.

Mr. Hehner, in replying, said he did not think there was the slightest doubt that the tin was in a dissolved state, for it was found not only in solid meats but in soups and curries and in compressed meats; also one could plainly see that it was not metallic tin; it was not only on the outer surface that the tin was found, but in the parts near the surface as well. He thought Mr. Wigner was very fortunate in getting samples free from tin, as he himself had obtained his indiscriminately, and invariably found tin.

ON THE COMMERCIAL ANALYSIS OF CINCHONA BARKS.

By JOHN MUTER, M.A., PH.D., F.C.S.

THE immense mass of writing on this subject places the analyst, seeking a good commercial process, much in the position of the patient who was killed by having too many doctors. Having, however, had occasion to study every proposed method from time to time, and being often asked for information, I now take the opportunity of laying before our readers the actual process which I find best in practice, and which I have modified from those originally proposed by De Vrij & Moëns.

As to the actual extraction of the crude material I will say nothing, except to state that, of the *published* processes, the extraction of the bark (previously mixed with milk of lime and dried) by successive portions of methylated spirit of 93 per cent., and then converting into sulphates and distilling off the alcohol, is the best, provided the alcohol is only strong enough (which may be cheaply attained by placing a quantity of freshly ignited potassium carbonate in a bottle of the strongest methylated spirit sold) and the bark and spirit are boiled together under an upright condenser. Bark analysts have generally an extraction process, which they keep secret, suitable to the method used by the chief manufacturers for whom they work; and I do not mean to infer that I, in practice, always use the extraction mentioned, but I say it is the best published process.

Suppose, therefore, that the bark has been extracted and the alkaloids obtained as sulphates in solution, I begin by the very old method of adding to a very concentrated solution—a distinct excess of sodium hydrate, and shaking out with 50 c.c. of chloroform, and then successively with three quantities of 25 c.c. each. This I find will bring back invariably 5·99 out of 6 grammes of pure mixed alkaloids, and is decidedly the most accurate method, given practice in the way of shaking, &c., so as to get the chloroform to settle quickly. The chloroform should be received into a small tared 5-ounce squat beaker, placed under a Wynter Blyth's recovery apparatus, and the residue dried in the bath at 212°, and then heated in the air bath to 240° F., and the fused mass weighed.

The total alkaloids are then dissolved in absolute alcohol, and the solution divided into two equal portions by weight, and treated as follows:—

Portion A is placed under a burette containing volumetric sulphuric acid (11·6 grms. acid of 1843 sp. gr. in 1 litre of water each c.c. of which = ·1 gramme crystallized sulphate of quinine) and titrated until just faintly acid to delicate litmus paper, and the acid used is noted as a guide for future operations. The spirit is then evaporated off, and the residue is dissolved in water at 185° F., using 5 c.c. of water for each c.c. of volumetric acid taken, and if not all soluble, then volumetric acid is to be dropped in until all is dissolved. The whole being still kept at 185°, very dilute sodium hydrate (4·74 NaHO per litre) is to be cautiously added, stirring well until the whole is *just all but neutral*. The amount of volumetric acid used to dissolve over that required at first to titrate, will be an index of the soda required, because the solutions are to be made to balance each other. The whole is now rapidly cooled to 60°, and kept at that point for an hour, and then filtered through a pair of filters previously mutually counterbalanced, and the filtrate received into a graduated c.c. measure. The crystals are washed with 1·5 c.c. of water at 60° for each c.c. of acid used in the titration, and when drained, well pressed, and dried first at 212°, and then gradually up to 240° and weighed, using the outer filter as a tare. The filtrate and washings are measured and ·000817 added to the weight of crystals of QUININE SULPHATE for each c.c. of the fluid. If the last drops of water running from the crystals are still acid, then the funnel must be placed over an empty beaker, and the washing continued with saturated solution of quinine sulphate at 60° F. till all free acid is washed away, as if not the crystals will char in drying.

Portion B is rendered *just* acid with hydrochloric acid, the spirit evaporated off, and the residue dissolved in the least possible quantity of water at 100° F. Dilute soda is added to neutralization, and then excess of saturated solution of Rochelle salt, and the whole cooled to 60° for an hour with frequent stirring. The precipitate is collected on a pair of mutually counterbalanced filters, washed with say 100 c.c. of water at 60°, and the filtrate and washings received into a measure. The precipitate is dried at 220° and weighed, using the outer filter as a tare, and ·00088 is added for each c.c. of filtrate. The quinine sulphate previously found is multiplied by ·915, and the answer is deducted from the weight of the mixed tartrates, and the balance multiplied by ·804 gives CINCHONIDINE. The filtrate from the tartrate is concentrated to its original volume, cooled, rendered just faintly acid by a drop of dilute acetic acid, and excess of saturated solution of potassium iodide is added with constant stirring. After an hour or so at 60° it is collected like the cinchonidine, and treated in every respect the same, and weighed, and the weight having had ·00077 added for each c.c. of filtrate and washings, is multiplied by ·7168, and result is QUINIDINE.

The filtrate from the quinidine is made distinctly alkaline by sodium hydrate, and the precipitated cinchonine and amorphous alkaloid are filtered out in a similar manner, washed and weighed. The precipitate is then treated with spirit of 40 per cent. to dissolve out the amorphous alkaloid and again weighed, and the difference is AMORPHOUS ALKALOID, while the last weighing is CINCHONINE. This is the worst separation in the whole process, but as cinchonine is the least valuable alkaloid it is not of any great consequence. The weight of the cinchonine and amorphous alkaloid together must have deducted from it ·00052 for each c.c. of the filtrate from the quinidine hydriodide, and ·00066 for each c.c. of filtrate rom the cinchonidine tartrate, and the balance is then the true weight, which, minus the amorphous alkaloid, gives the cinchonine.

The process is very expeditious, both portions going on at once, and the whole can be done in six hours. Of course, like all others, it requires experience, especially to see that the neutralizations are carried to the exact point, and the quantities of water properly judged, but, given that, I have frequently got back with it 99 per cent. of mixed pure alkaloids, and for Indian Barks it works very well indeed. There is nothing special in the actual separations, but only in the general manner of working, and the saving of time by using the two solutions, and in the collection on double filters so as to compensate the amount of solution absorbed in every case, and in the allowances which are not exactly perhaps theoretical, but what I have practically found the best. No allowance is mentioned for the solubility of cinchonine because it is very slight and not important. The allowance on the first step of *B* is a practical one based upon a usual sort of mixture of quinine and cinchonidine, but is to be modified according to the quinine found in part *A*. In practice, however, it is usually close enough.

SUBSTITUTE FOR ALUM IN MAKING BREAD.

By J. Napier, F.C.S.

I read with great interest the article by Mr. C. Estcourt, on the above subject, in the October number of The Analyst. Having since then obtained a sample of the liquid from Manchester, I am able to give some further information about it. The liquid is called "yeast improver," and is recommended to be used in the proportion of eight ounces per sack of flour (280 lbs.). It is manifest that this solution is not intended as a substitute for yeast, but merely as an adjunct in the case of new flours, and many English flours, where the binding qualities—so essential to making a good, easily-digested loaf—are somewhat lacking. Indeed, with some home flours it is almost impossible to get a satisfactory result.

I found the liquid to contain the ingredients, and in similar quantities, as Mr. Estcourt stated: phosphates of lime and magnesia, held in solution by phosporic acid. Having certain misgivings as to the purity of the materials used in manufacture, I tested for arsenic and other metallic poisons, but these were completely absent; so also were free sulphuric and hydrochloric acids. Alumina was present to the extent of ·06 per cent.

Using eight ounces per sack of flour—making 100 loaves,—thirty-five grains of the liquid will be found in every 4-lb. loaf. The free phosphoric acid in this quantity will not neutralise more than one-tenth the amount of earthy and alkaline phosphates naturally present. The percentage of alumina cannot be any objection to the use of the liquid, there being only ·021 grain—equal to ·13 grain alum—introduced into each 4-lb. leaf.

From the absence of impurities, it is very evident this liquid must be made from very pure materials. This is in striking contrast to the results of analysis of the sample reported to the Salford bench by Mr. J. C. Bell as being made from phosphates of alumina, lime, and magnesia.

I think it only remains for our chemical authorities to say whether or not this liquid, in the small quantities used, is injurious to health; but I think there can be little doubt that their decision will be in its favour.

The use of bread containing this solution will be decidedly beneficial in the case of children, where a plentiful supply of earthy phosphates is requisite.

LAW REPORTS.

What is Fair Notice to the Public that Milk Sold is Skimmed:—

At Worship Street, William Brainwood, a milk seller, of 480, Old Ford Road, Bow, was summoned for selling milk adulterated with 25 per cent. of water. Mr. B. J. Abbott defended. The evidence of William Walter Burrows, sanitary inspector of Bethnal Green, proved that on August 24th he purchased a pint of milk from the defendant in the street. The defendant vended his milk in the thoroughfares, going about with a van and large cans of milk. In reply to Mr. Abbott, the witness said he saw a printed card in the van stating that the milk was "country skim'd milk, sold as adulterated milk," at 2d. a quart; but he did not see it until after he had stated the purpose for which he had bought the milk. The defendant then told him that it was sold as adulterated. Witness did not believe that the card could be seen, because the defendant went from door to door serving the milk from a can he carried, and the van was in the road. Mr. Abbott relied on the notice, but the magistrate considered that under the circumstances it was no notice to the public. A certificate of Dr. Tidy, analyst for the parish, was put in, showing that an addition of water to the extent of 25 per cent. had been made, besides the abstraction of cream. Mr. Abbott then said that the defendant denied the addition of water, and asked for an adjournment to enable the defendant to have the sample left by the inspector analysed. The magistrate refused to allow any adjournment, and said he was satisfied, in the absence of any defence, with the evidence. Mr. Burrows added that the defendant had before been fined £5. The magistrates now fined him £10 with 2s. costs, or six weeks' imprisonment.

Objection that Sample not Personally Analysed by Public Analyst overruled:—

At the Hull Police Court, John Stephenson, cow-keeper, of Thearne, was summoned before Mr. E. C. Twiss, Stipendiary Magistrate, for selling, to the prejudice of the purchaser, a quantity of milk which was not of the nature, substance, and quality of the article demanded by such purchaser. The prosecution was instituted by the Urban Sanitary Authority of the Corporation and Mr. G. P. Spink appeared in support of the information. Mr. Laverack represented the defendant. Mr. Dale, Sanitary Inspector of the Hull Corporation, stated that on the morning of the 14th September, he saw defendant supplying customers with milk, and witness procured from him a pint of new milk, for which he paid 2d. He informed the defendant that he had purchased it for the purpose of being analysed by the Borough Analyst, to whom one-third of the pint was subsequently forwarded. Another portion was given to defendant, and the third part witness retained. Witness put in the analyst's certificate, which certified that the milk contained 25 per cent. of water. Mr. Laverack: He told you he had no milk to spare, I believe? Witness: Yes. Mr. Laverack: You got about the last he had? Witness: Yes; there was a little left. William Fox, assistant to the Borough Analyst, deposed that on the date named Mr. Dale brought them a quantity of milk which he had purchased from the defendant. Witness made the analysis. Mr, Baynes was present when it was made, and superintended it. They found only 6·25 of solids, not fat, and the results gave 25 per cent. of water. Mr. Twiss: According to your analysis I make it 31 per cent. of water. Witness: Yes, it is 31 as matter of fact. The whole analysis was in favour of the milk. It was not of the nature, substance, and quality of new milk. After cross-examining the witness as to the quantities contained in the analysis, Mr. Laverack submitted that the Act of Parliament was not complied with, first of all because the milk was not personally analysed by the "Public" Analyst. He said it was to be analysed by the "Borough" Analyst. The directions contained in the Act must be strictly complied with. Mr. Dale said that he mentioned Public and Borough Analyst to the defendant. Mr. Laverack considered it hardly fair to his client that this should be stated after he had raised his objection. Mr. Spink said he took it that Borough Analyst meant Public Analyst. In reference to the first objection, Mr. Twiss said that his impression was that if the Public Analyst were present from the commencement of the analysis to its fulfilment, and if he had somebody acting under his supervision the objection could not be sustained. Mr. Laverack said that being the case he would beg leave to call the defendant before his Worship decided the second point. The defendant was then sworn. He stated that on the morning of the 14th inst. his milk was sold out before had served all his customers, and he therefore purchased two gallons of milk from a milkseller named George Smith, for which he paid 1½d. a pint. He had disposed of nearly the whole of his extra supply when the inspector came up and purchased a pint of it. He (defendant) bought the milk in belief that it was as good as his own. Mr. Twiss: If that is the case Smith ought to be in defendant's place. Mr. Spink (to defendant): Did you never water your milk? Witness: No. Mr. Spink: Is it the custom of the trade to water it? Witness: Yes, a little sup. His Worship said that defendant and others could not be allowed to sell milk which was adulterated in this manner. If they purchased an extra supply they must know its quality, for the public must be protected. With regard to the second point raised by Mr. Laverack, he must believe the inspector's statement and overrule the objection. Defendant would be fined 20s. and costs.

Milk Adulterated through it Raining while Milking going on:—

Francis Mallisan, cowkeeper, of Hull, was summoned for a similar offence. In this case the analysis was also made by Mr. Fox, Mr. Baynes's assistant, and the certificate showed that the milk was adulterated with ten per cent. of water. In reply to his Worship Mr. Fox said a cow in the very weakest condition would give nine per cent of solids. This was their standard. In this the analysis showed only eight per cent. which gave adulteration to the extent of ten per cent. Defendant's excuse was that whilst milking the cows in the field on the morning of the 14th ult. it rained very heavily, and he thought about a pint of water fell into each of the milking buckets. That was all the water in the milk that he was aware of. He was not in the habit of watering his milk, not even to the extent of a table-spoonful. Many persons said his old milk was as good as new. His Worship said the evidence showed that the milk was adulterated. If it had been adulterated in the way defendant described he must be more careful in the future. Fined 20s. and costs. Defendant: May I ask if you are allowed to put any water in then? His Worship: No, certainly not.

Fine French Coffee containing 90 per cent. of Chicory:—

At the Bilston Police Court, before Mr. Boughey, the stipendiary for the South Staffordshire district, Mr. Richard Pinfield, grocer, of Ettingshall, was summoned by Mr. Horder, the inspector under the Food and Drugs Act, for selling coffee "not of the nature and substance demanded by the purchaser." Samuel Toy, assistant inspector, stated that on July 23 he went to defendant's shop, and purchased a quarter of a pound of coffee. The coffee was in a canister, labelled "Fine French Coffee," and on the label was a statement to the effect that it was a blend of fine East India and other coffees, carefully prepared by the new French process, whereby the aroma and properties of the coffee were carefully developed. The contents of the canister were analysed by Mr. E. W. T. Jones, the official analyst, who certified that the mixture contained 90 per cent. of chicory. The stipendiary said the mixture was not coffee; it was merely "stuff," and he could call it nothing else. As, however, the costs would be something heavy, he would in this instance only inflict the nominal fine of 5s. and the costs, £1 10s.—At the same Court, Mr. Isaac Boyard, grocer, of New Village, near Wolverhampton, was also charged by Mr. Horder with selling adulterated coffee. Samuel Toy, assissant inspector, said he went to the defendant's shop on July 23, and asked for two ounces of coffee. The coffee was given to him wrapped in a paper, on which were printed the words "Chicory and Coffee." The coffee was given to Mr. Jones, the analyst, who found that it contained 72 per cent. of chicory. Defendant was fined 10s., and £1 9s. 6d. costs.—Mr. William Phillips, grocer, of New Village, Bilston, was also summoned by Mr. Horder, the inspector under the Food and Drugs Act, for selling mustard not of the nature and quality demanded by the purchaser. Samuel Toy, assistant inspector, said he went to the defendant's shop on July 23, and purchased two ounces of mustard. The mustard was sent to Mr. Jones, the analyst, who found that it contained 49 per cent. of wheat flour. Defendant was fined 5s. and costs, amounting in the whole to £1 10s. 6d.

London Mustard containing Wheaten Flour:—

At the instance of the Glasgow Sanitary Department, A. M'Lean, provision merchant, 295, South Wellington Street, in that city, was charged before Sheriff Balfour with having sold adulterated mustard. On October 14 Robert Inglis, one of the sanitary officers, purchased a quarter of a pound of mustard in Mr. M'Lean's shop, and on being analysed by Dr. Wallace the mustard was found to contain 25 per cent. of wheaten flour. It appeared that the mustard had been sold by a girl, in the absence of the ordinary shopkeeper, and had been taken loose from a canister on which was printed a statement to the effect that the mustard was "London mustard," and a mixture of farina and choice condiments. This intimation was hardly noticeable to purchasers, and the girl did not intimate to the inspector that the mustard was a mixture. In the circumstances, the Sheriff held that while an offence had technically been committed against the Act, it was not a serious offence, and he would only fine Mr. M'Lean in the expenses of the prosecution—25s.

At the Rushall Police Court lately, before Messrs. F. James, S. Stokes, and T. A. Negas, a number of grocers were summoned for an alleged violation of the Adulteration of Food and Drugs Act. The first case was that of Mrs. Caroline James, who was summoned by Mr. J. G. Horder, the county inspector, for supplying goods not of the nature and substance demanded by the purchaser. Mr. Williams (of the firm of Duignan and Co.) appeared for the defendant. Mr. Horder said that on October 9 he went to defendant's shop and purchased two ounces of coffee. The sample, on being analysed by the county analyst, was found to contain 50 per cent. of chicory. In cross-examination the witness said the mixture was wrapped in a paper on which was printed "This is a mixture of chicory and coffee." The Bench considered the notification on the wrapper to be quite sufficient intimation to the purchaser that it was not pure coffee, and dismissed the case.—Mr. George Cresswell, grocer, of Walsall Wood, was charged with a similar offence. Mr. Bagnall (of the firm of Rowlands and Bagnall, Birmingham), instructed by the Birmingham and Midland Counties Grocers' Protection and Benevolent Association, appeared for the defendant. In this case Mr. Horder said the mixture contained 51 per cent. of chicory. The other facts were similar to those given in the preceding case, and the magistrates dismissed the case.—Sarah Stevens, of Walsall Wood, for selling coffee containing 63 per cent. of chicory, and William Bates, of Rushall, for having sold a mixture containing 69 per cent. of chicory, were also charged with a like offence. As the facts were at all fours with the previous cases, the summonses were dismissed.—Thomas Henry Whitehouse, of Sheffield, was summoned for having sold as half a pound of butter a mixture containing 92 per cent. of foreign fat. The witness for the prosecution said defendant stated at the time of the purchase that he had bought it for butter. Defendant was fined £1, and £1 8s. 6d. costs.

Coffee Adulteration.—Extraordinary Defence:—

Mr. Charles Isaac Walton, tea dealer, 233, Hoxton Street, was summoned at Worship Street Police Court by the inspector for the Vestry of St. Leonard, Shoreditch, for selling coffee as pure which was adulterated. Mr. Walker, Vestry Clerk, appeared for the prosecution, and Mr. Wontner for the defence. Evidence was given that three-quarters of a pound of coffee was purchased and was asked for as genuine. It was laid on the counter on an open paper and then was divided into three parcels and put in paper bags and sealed. One was left with the vendor, one was sent to the analyst, and one retained by the inspector. The certificate of Dr. Stevenson was put in, certifying that the sample contained the foreign ingredients as under: Chicory, 20 per cent. Mr. Wontner, for the defence, said he had a strange answer. They had sent the samples left to Dr. Hassall for analysis and he certified that the quantity of chicory was 30 per cent. But they believed that it was genuine coffee. They had a parcel of pure coffee which they sold from, and they could only account for it by the supposition that chicory was in the bags when the coffee was put in. Mr. Walker said that was a very improper statement. He should have to ask the inspector if the bags were clean and empty. The inspector was recalled and said the bags were new from the stationer's and had never been opened and were quite empty. Mr. Wontner then said they could not account for it as they believed the coffee sold was pure. He asked that the sample produced in Court should be submitted to the Government analyst at Somerset House. The magistrate consented, and the case was adjourned. At the adjourned hearing the certificate from Somerset House was put in, stating that it contained not less than 20 per cent. of chicory. Mr. Wontner called the proprietor and his employées to prove that the coffee was sent from the Mincing Lane establishment to this and several other places. They sent a canister to each of pure, labelled as such, and it was sold as such in the full belief that it was pure. The magistrate said there were some peculiar circumstances about the case which it was not for him to decide. It was admitted that chicory was largely used for mixing with coffee in this place; whether this was a mistake or not he could not say, but the evidence put before him was not sufficient to induce him to impose a less penalty than £5 and £1 2s. 6d. costs.

Extensive Adulteration in Scotland.—Heavy Penalty:—

In Chambers lately, before Sheriff Balfour, Alexandra Young, milk dealer, and residing with his father, William Young, farmer, Waterbank, Carmunnock, was charged at the instance of the sanitary authorities with having, on 18th October, from a cart in West Bothwell Street, sold to William T. Armstrong, one of the sanitary inspectors, four pennyworth of cream diluted with 62½ per cent. of skim milk, two pennyworth of sweet milk diluted with 36 per cent. of skim milk, and one pennyworth of skim milk diluted with 20 per cent. of added water. In answer to the Sheriff, Mr. Young said he was guilty, and that he was 22 years of age. Mr. Ross, who acted for the prosecution, said this was one of the worst cases that had ever come before the Court, and the locality in which the milk was sold was a poor one, inhabited chiefly by working people. The Sheriff said it was a very serious offence. The adulteration was very great; it was the worst case that had come before him. The percentage of adulteration usually varied from five to twenty, but in the cream in this case there was more skim milk than cream, the adulteration being 62½ per cent. The accused: Well, it was the price I had to pay for it. The Sheriff (continuing) said that in whatever locality these sales had taken place the offence would be great, but it was worse being in a locality like Bothwell Street, where the people were poor. It would have been competent for him to inflict a penalty of £20 for each of the offences, but he thought it would be too hard to impose three times £20. He would treat the case as if there was only one offence, and impose a fine of £18, which was just £6 for each offence. This modification was made because of the youth and inexperience of the accused, and he hoped it would be a warning to him for the future. Mr. Ross: Will your Lordship impose a substantial alternative in case of the accused not paying this large sum? The Sheriff: Have you any prospect of paying this penalty? The accused (who had a roll of notes in his hand) said he conld pay it now, which he did.

Milkman Fined for Adding Water to his Employer's Milk.

James Haines, in the employ of Morgan Morgan, purveyor of milk, carrying on business at 68, Alscot Road, Bermondsey, was summoned to Southwark Police Court by Mr. H. Thomas, sanitary inspector, in the service of the Bermondsey Vestry, for selling him milk containing 16 per cent. of added water, and Mr. Morgan, the master, was charged with causing him to sell it. Mr. Harrison, vestry clerk, prosecuted, and Mr. Washington appeared for the latter. Mr. Thomas said that on the 14th ult. he caused a pint of milk to be purchased from Haines as he was serving customers in Grange Road. He told him he intended to have it analysed, when Haines said he sold it as he received it from his master. Witness took a sample to Dr. Muter, whose certificate showed that it contained 16 per cent. of added water. On mentioning the circumstances to Mr. Morgan, he said that Haines must have added water to it after he left the dairy, as all the milk was tested before it was taken away. Mr. Washington, on the part of Mr. Morgan, produced a certificate showing that all the milk was genuine when Haines took it from the dairy. Mr. Thomas was recalled by Mr. Washington, and he said that on Haines being called by his master in reference to the milk, he said, "I own putting water in the milk; I have done it three times." He had known Morgan for some time, and he believed him to be a very respectable tradesman. The defendant Haines here said it was quite true what Mr. Thomas had said. He had frequently put water in the milk, and his master knew nothing about it. Mr. Washington informed his worship that Morgan paid Haines 26s. a week, and gave him what milk he required for his own use. It was very serious for Mr. Morgan. The magistrate dismissed the summons against Morgan, and fined Haines £5, or one month's imprisonment.

For some years past large quantities of butterine have been disposed of in Dublin as pure butter. Hitherto the fraud has escaped almost unnoticed, to the great loss of dairy farmers. Recently, however, the authorities, aroused to action by the Rev. Canon Bagot and other members of the Agricultural Society, have set their faces against the practice. Several of the vendors of this stuff were brought before the police magistrates by the Corporation and sanitary officials lately, and fined in sums of £5 and £10. The certificate of Dr. Cameron, city analyst, set forth that the samples submitted to him consisted of a compound of foreign fats, instead of butter fats. In one of the cases the prosecuting official deposed that one of the cools of butter was marked butterine, but over the "ine" was placed a similar label marked 10d., so that the apparent marking on the cool was "butter 10d." The magistrate said this was a very bad case of deception, and imposed a fine of £10.

NOTES OF THE MONTH.

The Irish are credited with having a method quite their own of dealing with matters; but if the statement of a Dublin dairyman is to be believed, an inspector who took some milk from him, which proved on analysis to be adulterated, actually called on him before issuing the summons, and said, "What day was it that I took that milk from you? because have forgotten the date." The milkman obligingly answered, "Och, sure! and wasn't it n [such a day]!" And then, after that, the inspector had him fined!

The Scotch, always "canny" in money matters, have also had their natural instincts exemplified lately. It seems that at a meeting to discuss the necessity of appointing an analyst, a saving ratepayer delivered himself of the following brilliant idea: "I don't see much use in gettin' an analyst. There's the pollis (policemen), they hae but little to do in the mornin'; they micht analeeze the milk, ye ken!"

Another case has been settled, which will be found in our police reports, in which the magistrate has decided against a mixture of 90 per cent. chicory and 10 per cent. coffee, sold in a canister labelled "fine French coffee," and having a statement to the effect that it was a blend of fine East India and other coffees, carefully prepared by a new French process whereby the aroma and properties of the coffee were carefully developed. There being a large quantity of similar articles about in all the shop windows, we should suggest that it would be a useful amendment to the label to leave out the word "developed," and insert instead "modified by an admixture of a blend of the finest and most carefully prepared roots of chicorium." That would sound very nicely, and might save convictions; while such a description would almost be more eloquent than that found on a tin of mustard with flour and turmeric, met with in the Glasgow police reports, stating it to be "London mustard," and a "mixture of farina and choice condiments." After this we shall have the milkmen selling "the natural milk of the choicest and most beautiful Alderney and other cows, prepared by a process whereby its nutritive qualities are specially dealt with; and it is rendered more easy of digestion by infants through careful admixture with a well-known agent supplied by a beneficent Providence—namely, hydric oxide!"

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1880 No.	Name of Patentee.	Title of Patent.	Price.
905	J. C. Loeffler	Covering Wire with Insulating Material	2d.
1295	E. M. Allen	Insulating Electrical Conductors	6d.
1304	W. R. Lake	Utilization of Bamboo Reed for Manufacture of Fibrous Materials	6d.
1310	W. C. Young	Manufacture of Sulphate of Ammonia	4d.
1324	T. Croysdale	Artificial Manure	4d.
1328	W. R. Lake	Telegraphic and Telephonic Apparatus	1s.
1329	W. R. Lake	Eliminating Phosphorus from Iron in Bessemer Converters	4d.
1354	C. D. Abel	Caloric Apparatus	6d.
1414	C. D. Abel	Caloric Engines	6d.
1365	S. Pitt	Preserving Alimentary Substances by Cold	6d.
1385	T. A. Edison	Electric Machines and Motors	6d.
1397	C. D. Abel	Electric Lamps	6d.
1402	C. D. Abel	Filters	6d.
1407	O. Heaviside	Electrical Conductors	6d.
1416	P. Jenzen	Production of Oxygen Nitrogen Gas	6d.
1456	C. Lowe and J. Gill	Manufacture of Coal Tar	4d.
1463	R. Evans	Preventing the Falsification of Cheques	6d.
1471	A. W. Gillman and S. Spencer	Manufacture and Treatment of Beer	4d.
1478	W. Mann and W. T. Walker	Purification of Coal Gas	6d.
1507	G. André	Electric Lamps	6d.
1510	G. Wells and A. Gilbert	Insulators	4d.
1511	J. H. Johnson	Telephone Switches	6d.
1512	W. A. Hills	Production of Tricalcic and Dicalcic Phosphates	4d.
1536	J. McLaren	Manufacture of Sugar	4d.
1546	J. H. Vale	Apparatus for Enriching Gas by Admixture of Hydro-Carbon Vapour	2d.
1552	A. M. Clark	Electric Lamps	6d.
1564	G. Davis	Prevention of Incrustation in Boilers	4d.
1615	E. P. Alexander	Treating Mineral Hydro-Carburets	2d.
1623	J. H. Johnson	Tanning or Preserving Hides or Skins	2d.
1649	W. R. Lake	Electric Lighting Apparatus	8d.
1672	S. A. Peto	Manufacture of Plumbago Crucibles	2d.
3228	H. H. Lake	Drying Sugar	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper *and Dairyman's* Journal; The Chemists' Journal.

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